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THE PROPHET'S COLUMN.

The ether will transmit speech as well as horse-power. The photophone of Prof. Bell shows that it is possible to talk along a beam of light between two distant points which are not connected by wire. Up to the present time it has not been possible to speak in this manner for a greater distance than a few hundred feet, but the wonderful fact has been demonstrated that a ray of light and, therefore, the ether can transmit speech.

If it is possible to talk for a few hundred feet, why not for a mile, and if for a mile, who can say what the limit is?

Singularly enough the photophone has as yet received no practical application and is at present interesting only from a scientific point of view, and when considered with reference to its possible effect on the art of telephony.

A system of telephony without wires seems one of interesting possibilities and the distance on the earth through which it is possible to speak is theoretically limited only by the curvation of the earth's surface. To be sure, fogs and mists would cut off the waves of light, but it has been shown that slower waves may be generated which are capable of electrical action, and which can be propagated through the densest fog and even through a stone wall with just as much ease as through the clearest atmosphere.

To speak again of the possibilities of using an electric or magnetic field to replace a lens of glass for optical instruments, it is not by any means restricted to telescopes. The essential feature of a microscope is the eye-piece, which should be a minute sphere of perfect glass. The grinding and polishing of such a small globule of glass as is required in a high power microscope is the only limiting factor in microscopy. It is conceivable that an electric field could be formed which would be as small as a mathematical point. What could we see with such a microscope? Fitz James O'Brien gives us, in his "Diamond Lens," a beautiful poetic vision of what his hero saw with a lens of immense power which he had constructed out of a large diamond and treated with an electric current.

While it is not likely that a powerful electric lens would reveal to our astonished gaze visions of prismatic groves and the beautiful "Animula" with whom O'Brien's hero fell in love and pined away because he could not speak to her; yet the scientific imagination goes on a flight which quite equals that of the poet.

This at once brings up the query: What is matter? We are told that matter is made up of molecules and that the distances between molecules are immense compared with their size. If we could conceive of a being small enough to exist on a molecule and he should gaze off into space the nearest molecules would appear to him at such distances as the stars do to us. The idea of a grain of sand containing worlds of its own is too stupendous even for a poet. Yet who can say that such is not the case. Then, to turn to the other extreme, suppose the earth to be an atom, our solar system and perhaps our universe forming a pebble on the shore of some vast ocean of space.

THE PROPHET.

The Relations of Abstract Scientific Research to Practical Invention, with Special Reference to Chemistry and Physics.

ABSTRACT OF ADDRESS BY PROF. F. W. CLARKE, BEFORE THE INVENTORS' CONGRESS.

A hundred years ago, in 1791, Galvani published his book on animal electricity, and at nearly the same time the Royal Society awarded the Copley medal to Volta. Between these events and the foundation of our patent office there was no obvious relation; but the science grown from those germs is now one of its chief objects of activity. At the time they were made, Galvani's work had no practical significance, and many other illustrations were cited by the speaker to show that applied science always has its roots in researches of a purely abstract nature. We can have no applied science unless we have the science to apply, and so it happens that the nations which encourage scientific investigations, acquire thereby industrial supremacy. The agencies which develop research are individual enterprise, schools and universities, scientific societies and government aid. Of these the university is the chief, and in the university laboratories nine-tenths of the purely scientific discoveries are made. A true university is a producer as well as a distributor of knowledge, and by recognizing this fact Germany has become the leader of modern science. A chemist who has done no original work can have no prominent position in Germany. The speaker urged that training in pure research be more cultivated than hitherto in American schools, where now the so-called "practical view" prevails. The student should learn how to discover; how to solve unsolved problems; for that is the mainspring of modern industrial growth.

Of government aid to science the speaker said little, except to show that the relation was a material one, and that in receiving help from science the State should render help in return. He then went on to speak of the gaps in our knowledge, due to the individualism of workers, each laboring for himself without reference to what others were doing. Co-operation is necessary, and along lines where the inventors and manufacturers can help, there should be established laboratories for research, in which the problems too large for individual effort could be properly handled, and important physical constants determined. Such constants are of fundamental importance to pure and applied science alike, and their measurement should not be left to personal convenience. Some of the wealth reaped by the inventor from applications of science might well go back to its source as seed. The research laboratory, in which the workers need not be overloaded with other duties, is the great desideratum for chemistry and physics today.

FIG. 1.—THE HOCHHAUSEN ALTERNATING CURRENT FAN MOTOR (SEE PAGE 123).

Growing Scarcity of Gutta-Percha.

What the projectors of the Guatemalan and Pacific cables are to do for insulation is a serious question. There simply is not enough of the sort they want, and that, as they say, settles it. An attempt to buy such a quantity would send gutta-percha up to four or five dollars per pound. The Guatemalan people have fairly decided to use caoutchouc. If both should decide to use Para it would mean something to the rubber market.

There is no good substitute for gutta-percha. Balata would not do even if it could be had in quantities enough. On the banks of the Orinoco a gum is said to be nearly if not quite equal to gutta-percha, but it has not figured in commerce much beyond the botanical gardens.—*India Rubber World.*

To Our Advertisers.

If you intend to move about May 1, send the REVIEW your old and new addresses. In accordance with our custom, we shall be glad to mention the matter to our readers.

ELECTRIC CLUBS.

New York Electric Club.

The Annual Election of the New York Electric Club was held Thursday evening of last week and passed off very pleasantly. The ticket as regularly nominated was elected, except where nominees had declined. The meeting was called to order by the secretary and Mr. Chas. Dutton elected chairman and Messrs. E. A. Colby and J. D. Bishop appointed tellers. The gentlemen elected are:

President—Samuel Insull.

Vice-presidents—Charles W. Price, Erastus Wiman, W. L. Candee, Edward Weston.

Secretary—Stephen L. Coles.

Treasurer—Geo. M. Phelps.

Board of managers—H. L. Shippey, P. H. Alexander, T. C. Martin, C. E. Stump, E. F. Peck, E. E. Bartlett, Dr. J. B. DeLery, H. D. Cheever, Chas. D. Shain, Joseph Barré, C. O. Baker, Jr., H. D. Stanley, J. H. Herrick.

Committee on membership—Charles Dutton, C. H. Barney, Geo. T. Manson, S. S. Wheeler, Joseph Wetzler.

Annual Statement.—President O. E. Madden presented at the annual meeting a printed financial statement covering the 18 months of his presidency of the Club. The report is very interesting and should be in the hands of every member. It is the most complete and valuable statement of the Club's condition that has ever been made, and shows a change from a deficiency of $7,339.47 on October 31, 1889, to a surplus of $3,677.54 March 31, 1891, a gain of $11,017.01. The membership March 31, 1891, is shown to be 17 life members, 124 associate and 167 active, a total of 308. Since that date about 30 new members have been elected. General Madden declined re-election and retires from the presidency, which he has filled with such signal ability, with the esteem of all. His work for the Club speaks for itself and his earnest and zealous devotion to its advancement is deserving of the highest credit. Mr. Samuel Insull, the newly elected president, is a progressive gentleman, widely known in electrical circles, who will undoubtedly work successfully for the Club's advancement and be supported by all the members.

Franklin Experimental Club.

The Franklin Experimental Club, of Newark, N. J., gave an electrical entertainment in the parlors of the First Presbyterian Church, of Orange, N. J., last week. Addresses were made by General Manager Upton, of the Edison lamp works, and others. The experiments were novel and interesting.

Wanted—A Miner's Electric Lamp.

The council of the Federated Institution of Mining Engineers, of England, is desirous of receiving exhibits of miners' electric safety lamps, to be shown at the annual meeting of the Federated Institution of Mining Engineers, to be held in London on May 27 and 28 next. Intending exhibitors are desired to communicate with or send their exhibits to the secretary.

THE KILLING OF KEMMLER.

BY J. E. TALBOT, FORT WAYNE, IND.

[Written for the ELECTRICAL REVIEW.]

An announcement appeared in a recent issue of the ELECTRICAL REVIEW in reference to the cases, now so long pending, of two murderers awaiting the death penalty, which, under the law of the State of New York, as it at present stands, can only be inflicted by means of the electric current.

This recalls and revives some interesting questions.

Although the subject is one that has been treated almost *ad nauseam* by various authorities, with various objects in view and for different reasons, yet it seems as if the actual effect of an electric current of relatively high potential difference on the human frame still remains in considerable obscurity.

That a clear determination of the results produced by such a current would be of value is scarcely to be questioned, in view of the fact that "electro-execution" is now in the State of New York the only legal method of carrying out the death penalty, and also for the reason that employés of electric light and power companies are, from the nature of their employment, more or less liable, from carelessness or otherwise, to receive shocks from conductors carrying currents of this character. If the exact operation of high potential currents, whether direct or alternating, as applied to animal organisms, could be authoritatively determined, it might enable precautionary or remedial measures to be taken which would result in the preservation of some valuable lives, and in the decent and humane removal of others which the State has decided it has no further use for.

Even among those persons who have given the subject special attention in the past, there exists a very wide difference of opinion on this subject.

Dr. George T. Shrady, in the *Arena*, says, with regard to the Kemmler execution: "As now shown, there was no accurate and reliable way of determining positively when real death occurred. Although the respiratory struggles of the criminal after the first shock were as free from pain as if the man had been dead under the influence of an anæsthetic, there is little doubt that he might have rallied if the shock had not been repeated."

On the other hand, Dr. Carlos McDonald, who was another expert attending the execution of Kemmler, is reported in the New York *World* as saying: "Notwithstanding the wide publication of unofficial reports of the execution of Kemmler and the efforts that have been made to proclaim it a failure, and to invest it with an air of repulsion, brutality and horror, it is confidently believed that, when all the facts are rightly understood, the first execution by electricity will be regarded as a successful experiment."

Nevertheless, he recommends that a voltage of 3,000 be employed, in lieu of the pressure actually used, whatever that may have been.

The facts regarding this first execution were so surrounded with secrecy, prejudice and interest, that it is difficult to arrive at a true understanding of the actual condition of affairs, but, probably, when these mists obscuring a proper view of the circumstances have disappeared, this will be found to be the case, viz., that the electrical pressure varied within very wide limits; that the resistance of the subject also varied within somewhat narrower but still wide limits; that the murderer was killed by the first application of the current; that the burning effect was subsequently produced by poor contact with the electrodes, and that the information that we might have obtained by a post-mortem after the first shock was given, has been shut off from us by reason of effects due to the second application of the current.

It is a very simple and easy explanation of the phenomenon of death by electricity to say that it results from shock to the nervous system—or arrest of the heart's action, or of respiration. These, however, are merely convenient ways of expressing our ignorance.

How do these results follow? Can we get at the back of what the name of the thing is called, and find out what the thing itself is?

In order to do this, the particular action, or set of actions which follows the administering of an alternating current of approximately 1,000 volts must be differentiated from all others, and this is a most difficult thing to do. At this point it may be noted that we do not possess any definite information as to what the voltage of the machine used for despatching Kemmler actually was. The attempts at secrecy adopted in this case entirely failed of their real purpose; they were just inefficient enough to raise a suspicion that the affair would be bungled, and sufficient particulars of the real facts were not supplied to remove this suspicion. The machine was supposed to be a so-called 1,000 volt machine, which voltage, however, may vary according to the speed of rotation and degree of excitation, from nil to possibly 2,000 volts.

Another variable factor in the determination of this question which has been the subject of considerable discussion, is the varying resistances which obtain, not only as between different subjects, but in the same subject at different times. Thus, Messrs. Lawrence and Harries, in a paper read before the British Institution of Electrical Engineers, say: "We feel sure that no hard and fast lines can be laid down on the subject. Individual resistance and individual sensitiveness vary so much and so unexpectedly, that a current that might be taken with impunity by one person might be more than enough to kill another." This, indeed, is matter of familiar knowledge to all of us. Even with the small induction coils or magneto-electric machines used for domestic and medical purposes, the effects produced on different persons are widely and inexplicably dissimilar. It would appear to be a matter of constitutional nervous susceptibility.

In connection with this subject, it would be interesting to know what the result would be of an electrical current applied to a subject whose nervous system was inactive or under the influence of an anæsthetic. Dr. Edward Tatum has made some experiments upon the lower animals in this direction, and appears to have satisfied himself that the nervous action operated on the heart rather than upon the respiratory functions, but like all the other experiments on this subject, the results are not of a very definite character.

In 1887 M. d'Arsonval presented a note on this subject to the Academy of Sciences, in Paris, through M. Brown-Sequard, in which he related a number of his experiments.

With regard to the effects produced by electric currents upon the human organism, especially with regard to the death effect, among other things, he said that "electricity produced death in the two following ways: 1. By a direct action (disruptive effect of the discharge operating mechanically so as to injure the tissues). 2. By reflex or indirect action (operating on the nervous centers, the irritation of which involves an infinite variety of effects, so well studied by Brown-Sequard, under the names of inhibition and dynamogeny)." He says, further, "That this simple distinction, which is the result of careful observation of facts, has also a practical value in this sense, namely, that in the first case death is fatal and definitive, whilst in the second case, experiments have shown that one may very frequently restore the individual to life by means of artificial respiration if resorted to immediately after the accident;" and, *apropos* of this, it may be noticed that M. Brown-Sequard has stated that faradization of the sides of the larynx applied to the moistened skin or to a superficial incision is effective in the direction of inducing artificial respiration.

The following appear to be the only two causes of death indicated by this writer; either an actual disruptive effect upon the tissues of the body, which would appear to partake of the nature of a mechanical effect, and the other, simply a shock to the nervous system. How this shock to the nervous system may have power to produce death, is something of a mystery, even at the present date. We are not aware that the medical profession has definitely come to any conclusion as to how death by nervous shocks actually results, whether by paralysis of the brain, or by stoppage of the heart's action, or in what other manner. Instances have been known, indeed, where people have been simply frightened to death by sudden shocks of other kinds, involving no mechanical injury. How this mental action operates physically on the brain or heart, or both, is still doubtful.

It is possible, however, that the views of M. d'Arsonval may undergo a further modification, as, in a communication to the Biological Society (French) in 1887, he says that the E. M. F. of an alternate current machine ought not to exceed 60 volts, and in the light of present experience, we are well aware that this would be an absurdly low limitation of pressure.

In an article written by Gustave Roux, in 1886, he puts the matter as follows:

1st. If the head of an individual touches a conductor carrying a high potential current, death is certain, because the discharge is made through the brain, and consequently through all the vital nerves and organs of the person.

2d. If the contact that takes place is made with a hand or shoulder, the effect is less serious; however, if the individual is only resting on the foot opposite the hand that touches the conductor, the discharge will pass through the heart and the abdominal muscles.

3d. If the discharge is made through two arms, it will be fatal, as it will pass through the heart.

To sum up the matter, he says, that wherever a discharge traverses the principal organs of the body, death is inevitable. He says, however, that frequently the person injured in this manner may be restored to life, especially if it is an alternating current which produces the apparent death. He also refers to the fact that Prof. Houston, in a note published in the proceedings of the American Philosophical Society, explains this fact by saying that an alternating current only produces a simple shock, so that the blood and tissues are not changed in nature, whereas, continuous currents, on the other hand, produce at first a powerful convulsion, which throws the individual affected into a state of complete prostration, and then follows electrolysis of the blood and the muscles of the body, thus rendering resuscitation impossible.

There is no doubt that these statements, in the light of latter experience, cannot be accepted as entirely correct. There are numerous instances known to those engaged in practical work where persons have received a shock of 1,000 volts and more, and beyond slight burns and a general shaking up, have not sustained any injuries. Indeed, at the date of the article of Roux, to which we are now referring, he says that certain other experimenters relying upon the post mortem appearance of persons killed by electric shocks, attributed death rather to a simple aphyxia, than to a physico-chemical action, which they explained as follows, viz., that when a powerful current is passed through the body, it acts on the nerves, which in their turn produce a violent and instantaneous contraction of the muscles, at the same time the nerves become paralyzed, then the muscles gradually relax but cannot resume their functions. Death is primarily caused by a complete prostration of the nervous system operating upon the brain, and this sudden prostration is continued by the asphyxia resulting from the inactivity of the muscles. The muscles are unable to act without the assistance of the nerves, and when these are paralyzed and inert, circulation ceases with the cessation of the heart's action, whence results "permanent" death, *i. e.*, without possible resuscitation.

It has been suggested theoretically (and also it is believed been practically tried with more or less success) that when death is only apparent, or, if we may use the expression, "conditional," artificial respiration may be resorted to. This course is, no doubt, what Dr. Shrady referred to in the case of Kemmler.

In Professor Houston's electrical dictionary we have the following statement of the various causes of death due to an electrical current. Death may be occasioned, he says:

1. As the direct result of physiological shock.

2. From the action of the current on the respiratory centers.

3. From the actual inability of the nerves or muscles, or both, to perform their functions.

4. From an actual electrolytic decomposition of the blood or other tissues of the body.

5. From the polarization of those parts of the body through which the current passes.

6. From an actual rupture of parts by a disruptive discharge.

The current required to cause death will depend on a variety of circumstances, among which are:

1. The particular path the current takes through the body, with reference to the vital organs that may lie in this path.

2. The freedom or absence of sudden variations of electromotive force.

3. The time the current continues to pass through the body. In most fatal cases, it is probably the extra current, or the induced direct current on breaking, that causes death, since, as is well known, its electromotive force may be many times greater than that of the original current.

This, unfortunately, is too general to enable us to predicate the cause of death in any specific case. A physician can predict with almost absolute accuracy what will be the result, and what will be the cause of death in the cases, for example, of the firing of a bullet into a man's brain, or of opening an artery, or of administering a certain dose of strychnine, and can give a clear and rational explanation of the chain of phenoma leading to the fatal termination.

Take, however, two cases:

(1) That of a man holding by his two hands the terminals of a 3,000 volt continuous current machine kept at 3,000 volts; and (2) that of a man similarly holding a 300 volt continuous machine (which would undoubtedly produce death in time) also kept at that pressure.

Could any physician determine beforehand the cause of death in each case? And would it be the same if the two machines were changed to alternating machines?

The specific post-mortem appearances noticed in the case of Kemmler are rather puzzling, the dark color of the blood which escaped on incising the sternum would indicate decomposition. Whether this decomposition was the result of electrolysis, or was merely natural post-mortem decomposition is an interesting question, especially in view of the generally accepted theory that alternating currents will not produce electrolysis. It was said, also, that the granulated appearance of the blood taken immediately after death, suggested an electrolytic dissolution of the red corpuscles.

It has been noticed in the case of animals that the blood after death by electric shock has been black and very fluid, the right side of the heart being full of blood and the left side empty. The principal nerves, examined under the microscope, have not, however, presented any abnormal appearance.

When such a man as Dr. Lothar Meyer admits ("Modern Theories of Chemistry," page 287) that "the connection between the electrolytic property of a compound and the chemical nature of its constituents is difficult to determine, because the physical properties which influence the electrolytic decomposition vary with the composition of the body;" we can well see that we are only at the beginning of an apparently long and abstruse inquiry. Again, he says (page 294), "Although the nature of electrolysis is not clearly understood at the present time, there is no doubt that the passage of the electricity through the electrolytes, is intimately associated with the different movements which occur in liquids in the *absence* of electrical excitement. These movements are rather used in the passage of electricity than caused by it."

The writer would suggest that even if alternating currents do not finally kill by nervous shock, and do not produce chemical electrolysis strictly so-called, yet that they may produce what might be called a mechanical electrolysis, somewhat analogous to endosmosis. The passage of a current through a conductor produces undoubtedly a "set" or change of position of the constituent molecules or of the atoms in the conducting body; if this conductor also happens to be what we call an electrolyte, we obtain a different action, viz., the migration of ions, which is an actual positive displacement as distinguished from a mere change of position in the same location. Chemical change, composition and decomposition, may be considered as mechanical change "writ small," the distinction between what we have been accustomed to call mechanical change and chemical change having been really an arbitrary one, and the scientific frontier between the two is less well defined than formerly.

As an indication of the probability of some such solution being the correct one, the recent experiments in England of Messrs. Lawrence and Harries (see their paper before Society of Arts, March 11) may be referred to as instructive and suggestive. There clearly appeared to be a mechanical transference through a porous septum without any electrolysis, and it seems to be a not vehemently improbable hypothesis to assume some similar action as occurring in the intervascular septa of the human body under conditions and with limitations which require further investigation. Such a theory would tend to explain the non-appearance of electrolytic symptoms in the case of Kemmler and others, where indications of decomposition might have been anticipated.

Probably the actual sensations of those subjected to an alternating current shock of 1,000 volts are not a very safe guide to the actions which take place, but a careful collation and comparison of these might afford valuable information. It has been noticed that different men experience different sensations—one man who received an alternating current of over 1,000 volts directly from a switchboard said he felt first as if he were struck with a base ball club on the back of the neck, and then for that period of time, which seemed about five minutes, he could feel every beat of the machine through his body, and the acuteness of the pain was intense. Next morning, except for a couple of burns on his hands, he was all right again. Others have described the sensation as similar to a severe blow—others again have felt as if their internal organs were being ripped and torn to pieces. The effects on different individuals are curiously different, and so, also, is the ability of different individuals to withstand shocks. Again, the same person may at one time be much more severely affected by a current than at another.

It would seem that the electrical resistance of the body (even assuming an equally good contact) may vary with the condition of health, or it may be simply that the nerves are simply more sensitive to the passage of a current at one time than other. Careful

experiments on this subject would be of value if carried out by impartial and competent observers, not persons who have some "axe to grind."

An enquiry of this kind would not be merely of scientific interest; it will, no doubt, happen that with the numerous lighting and power stations and the thousands of miles of conductors throughout the country that men will at times be injured, either by carelessness, negligence or unavoidable accident. Assume the case of a lineman "hung up" on an arc or high pressure alternating circuit—he is got to the ground apparently dead. If, now, there has been decomposition, he is, no doubt, finally dead and there is no hope of saving him; suppose, however, there is only a nervous shock with suspension of the heart's action, or that of the organs of respiration—might it not be possible to excite the heart's action or induce respiration, or if the muscles are paralyzed, to stimulate them, and if so, is not the possibility of saving many valuable lives worth some study and labor?

If the electro-execution of two or three worthless criminals should lead to a careful and exhaustive enquiry into the question of how is death caused by electricity, the passage of the New York law may prove even yet of some service.

LITERARY.

"Bulletin de la Société Internationale des Electricians," for March, 1891, has been received.

We have received a copy of the official programme and souvenir of the Inventors' Congress, held in Washington recently.

The Cassell Publishing Company have just concluded arrangements with the distinguished Spanish novelist, B. Perez Galdoz, by which they become his publishers for all English speaking countries.

Darling, Brown & Sharpe, Providence, have sent us a handsome reproduction of the diploma which accompanied the award of a gold medal to them by the Commissioners of the Paris Exposition of 1889.

Bearing upon the question of municipal control of electric lighting, we have received the argument of Hon. Everett W. Burdett in remonstrance before the committee on manufactures of the Massachusetts legislature.

Sister Rose Gertrude has written another article for *The Ladies' Home Journal* for June, on "What it is to be a Leper," in which she gives a clear glimpse of leper life in Molakai; how the disease is contracted; how it is treated and cured, and how the lepers live in their exile.

The May *Cosmopolitan* will contain an interesting article on the silver camp of Colorado-Leadville, by Theodore Van Wagenen, the well-known mining engineer. The article accurately describes the camp and its environs, and is accompanied by a series of most curious photographs of miners at work, taken chiefly in the "Iron Silver" Mine.

"Experimental Electricity," by Edward Trevert, published by the Bubier Publishing Company, Lynn, Mass., has been received. This book is designed for the use of beginners in the study of electrical science. Technicalities are strictly avoided and directions are set forth for making simple electrical apparatus, by the use of which the student may obtain a considerable amount of practical electrical information.

The *New England Magazine* started a series of articles on electrical subjects in the March issue. The article in the April number is by George Herbert Stockbridge, one of the editors of our contemporary, *Electric Power*. Mr. Stockbridge writes entertainingly of "Later History of Electricity." The article is well illustrated, the pictures including portraits of Elihu Thomson, Thomas A. Edison, Edward Weston and Cyrus W. Field.

"Hints to Power Users," by Robert Grimshaw, published by the Cassell Publishing Company, 104 and 106 Fourth avenue, New York, has come to hand. The author is a well-known engineer and has written the book for a hitherto neglected class—the men who pay the bills. The matter is meaty and practical, and the style direct. In form the book is of a convenient pocket size. It is well printed and bound and altogether attractive and valuable.

"Dynamos and Electric Motors: All About Them," by Edward Trevert, published by the Bubier Publishing Company, Lynn, Mass. This work is a compilation of articles from reliable sources, which, it is thought, will prove to be of service to amateurs or students of electricity. Small machines especially are considered. In a general way, the work is of a sketchy character and technical terms are sufficiently avoided to make the book of value to the student.

Valuable Electrical Work of the Excelsior Electric Company.

NOVEL ELECTRIC SWITCH.

Several novel pieces of electrical apparatus worthy of notice are being manufactured by the Excelsior Electric Company, of this city. We illustrate herewith an admirable switch of special value in motor circuits for preventing heating of the armature by cutting into circuit a resistance which remains in circuit until the motor has acquired sufficient speed to develop its counter electromotive force. The switch is mounted, as will be understood from the engraving, in an iron case provided with a hinged door. Projecting from one side of the case is a crank mounted on a screw shaft which actuates the switch. The shaft passes through a nut, as indicated in the engraving, and is pivotally connected to a switch arm. The advantage of the threaded shaft is that it prevents a sudden shifting of the switch, and, therefore, the rapid admission of the entire current strength to the motor, as is common with switches as ordinarily constructed. It is impossible to throw the switch and admit current to the motor except by turning the crank, when the screw is gradually fed through the nut and tilts the switch arms. There are three of these switch arms, two of which form a double pole arrangement so as to open the circuit at two points, and the other of which is a supplementary device for

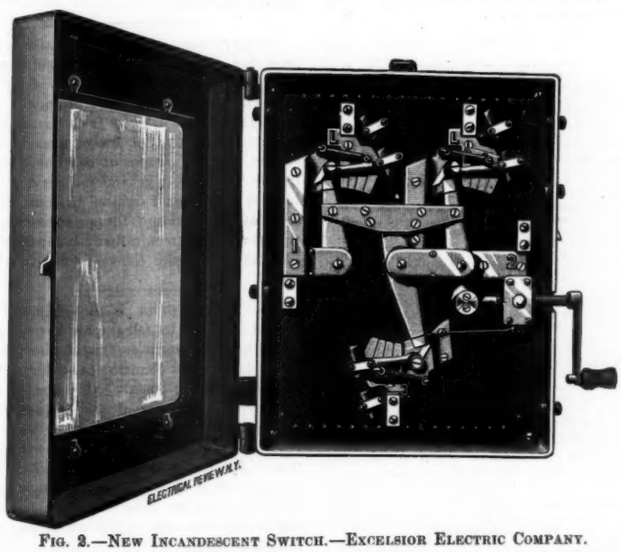

FIG. 2.—NEW INCANDESCENT SWITCH.—EXCELSIOR ELECTRIC COMPANY.

cutting in and out the resistance. The resistance consists of a series of coils mounted at the back of the box and not visible in the engraving. As will be seen, three switches are shown, each of which co-operates with two contact blocks insulated from each other. One of these blocks, as that shown at L, carries a piece of carbon rigidly mounted, and the other carries a pivoted arm elastically held by a spring, another piece of carbon being mounted in the end of the pivoted arm. It will, therefore, be understood that when the two pieces of carbon come into contact, the circuit, through the contact blocks, will be completed through the instrumentality of the pieces of carbon. These pieces of carbon may be renewed and new pieces put in when necessary. The sparking which is created in the use of the switch exists between the carbons only, thus preventing damage to the metallic parts of the switch. The pivoted arm carrying the movable piece of carbon has a depending arm or lug, which in the position of adjustment shown is engaged by the switch arms, thus tilting the movable piece of carbon away from the fixed piece against the tension of the springs. In this condition of adjustment the circuit is opened, but as the crank is turned and the screw forced inwardly the upper switch arms tilt to the right, and the lower switch arm to the left, thus moving the ends of the arms away from the projections on the pivoted contacts and permitting the springs to act upon them and close the circuit by bringing the pieces of carbon together. The device is so arranged that the two upper pairs of carbon contacts are brought into engagement a certain interval of time before the lower pair of carbon contacts, the resistance coils being electrically connected with the two blocks upon which the two carbon contacts at the bottom are mounted. This is accomplished by permitting a certain amount of lost motion between the lower switch arm, belonging to switch No. 3, and the upper switch arms. A cross-head or bar of insulating material is provided with a slot wider than the end of the switch arm, so that the latter will not be acted upon until a certain definite interval of time after the upper contacts have been made. This interval may be regulated by widening the slot, as will be readily understood. It results from this that as the crank is turned and the switch arms thrown gradually to the right, that the circuit is first completed through the upper sets of carbons, and the lower set still remaining open, current is forced to traverse the resistance, thus admitting a little current to the motor and permitting it to acquire sufficient speed to develop its counter electromotive force. As the crank continues to be turned, the two lower carbon contacts will eventually be brought together and the resistance will be short-circuited, the whole body of current then passing through the motor. It will thus be seen that however great the hurry of the operator, he cannot shift the contacts so as to put full current through the motor without allowing a sufficient interval of time to elapse from the instant the circuit is closed until the whole strength of current passes through the motor to prevent danger to the armature. As the switch arm with which the screw shaft is connected is mounted on a fixed pivot, the nut through which the screw passes is given sufficient play to permit the screw to feed without binding.

ALTERNATING CURRENT FAN MOTOR.

Another interesting device which is meeting with a cordial reception on the market is a fan motor, designed by Mr. Hochhausen, electrician of the Excelsior Electric Company, for use with alternating currents. The motor is simple in design and light in weight, and will drive a 12-inch fan at 1,000 revolutions per minute with a current of about one ampere. The whole apparatus, motor and pedestal, as illustrated, weighs only about 15 pounds, thus rendering it very portable. The motor comprises an arc-shaped laminated field magnet, and a continuously wound drum armature, having a finely laminated core and a commutator, the field magnet and armature windings being connected in series relation. The motor is used on a 50 volt transformer circuit and exhibits almost no sparking. The simplicity of the device is one of its chief recommendations, presenting many analogous points of construction to a direct current motor, except its fine lamination, which adapts it for alternating currents. There is very little heating of the iron when the motor is in operation. This is one of the simplest forms of alternating current motors yet proposed; it is commercially in the market, and although not for heavy work, will find a large field of usefulness in a number of commercial and domestic applications of electricity in which but little power is required, such as the operating of fans and the driving of sewing machines.

Nashville, Tenn.—Capital Electric Company; capital, $200,000.

New York City.—New York Electrical Exchange; capital, $1,000.

Sheffield, Ala.—Sheffield Electric Light Company; capital, $50,000.

Phoenix, Ariz.—Phoenix Electric Light Company; capital, $100,000.

Los Angeles, Cal.—Los Angeles Electric Company; capital, $150,000.

Washington, D. C.—U. S. Electric Light Company; capital, $700,000.

Nashville, Tenn.—The United Electric Railway; capital, $1,000,000.

Fresno, Cal.—Fresno Gas and Electric Light Company; capital, $500,000.

Muskegon, Mich.—The Shaw Electric Crane Company; capital, $150,000.

San Francisco, Cal.—California Electric Light Company; capital, $5,800,000,

Bristoe, Va.—Danville & East Tennessee Telegraph Company; capital, $90,000.

Chattanooga, Tenn.—Chattanooga Electric Light Company; capital, $100,000.

Montgomery, Ala.—Brush Electric Light and Power Company; capital, $100,000.

Yoakum, Tex.—The Yoakum Electric Light & Ice Company; capital, $50,000.

Haverstraw, N. Y.—Haverstraw Electric Light, Heat and Power Company; capital, $35,000.

Knoxville, Tenn.—The Knoxville Schuyler Electric Light & Power Company; capital, $40,000.

New York City—The Direct Electric Company; capital, $5,000,000. Incorporated in West Virginia.

Denver, Colo.—The Mica Asbestite Insulating Company; capital, $350,000. Manufacture insulating appliances.

Little Rock, Ark.—The capitalization of the City Electric Street Railway Company has been increased to $500,000.

Birmingham, Ala.—Birmingham Railway and Electric Company; capital, $3,000,000. Consolidated Electric Company; capital, $500,000.

New York City.—The Automatic Street and Station Indicator Company, of New York; capital, $500,000. Incorporated in West Virginia.

Denver, Colo.—The Dimon & Adams Manufacturing Company; capital, $60,000. Construct and manufacture electric street railway supplies.

Texarhana, Ala.—J. Deutschman and others have incorporated the Texarhana Light and Power Company, to purchase and operate an electric light plant. The capital is $125,000.

Newark, N. J.—The Mason Battery and Electric Company; capital, $30,000. The company will manufacture electrical appliances, batteries, etc. The incorporators are George E. Peck and Matthew Taylor, New York; W. A. Law, Brooklyn, and Henry A. Potter, Orange.

Philadelphia, Pa.—The Philadelphia Electric Service Company, to do business in Camden and Philadelphia, with a capital stock of $100,000; to procure license and exercise rights covered by letters patent, under agreement with the National Electric Service Company in New York. The incorporators are F. M. Brimley, E. W. Dwight and Samuel W. Wray, of Philadelphia.

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NEW YORK, APRIL 25, 1891.

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Isn't it about time we heard from that man who says "la grippe" is due to a large amount of electricity floating about in the air? Or, did we silence him last year? Or, has "la grippe" silenced him?

Our English brethren now complain that the French they get over the telephone line from Paris is not the kind they had become accustomed to in their correspondence! That is a peculiarity of the language that the telephone cannot overcome—it is different when it is spoken!

Mr. Talbot's article on the killing of Kemmler, which will be found on another page, is the result of considerable research and study of the matter, and contains much important data. The question is brought up to date, and the article, as a whole, is an interesting and valuable addition to the literature on this topic.

The Chicago office of the ELECTRICAL REVIEW, in charge of Mr. L. W. Collins, will, after this date, be located at 435 "The Rookery." This is one of the handsome office buildings of the world and the electrical building of Chicago. Our friends, especially those from the West, will always be made welcome by our Chicago representative.

As regards efficiency, the comparison between a good arc light and a doughty policeman is largely in favor of the more inanimate object.

The stockholders of the Third Avenue Railroad Company of this city have authorized the directors to issue $4,000,000 second mortgage bonds for the purpose of supplying the funds necessary to construct the cable road. Too bad, too bad! Good money going where it will not do nearly as much good as it would if invested in an electric road.

The Albany exchange of the Hudson River Telephone Company seems to have encountered a condensed lump of hard luck. Within a brief period, four serious interruptions of service have been experienced. The company has always been excellently managed and well equipped for business. Immunity from serious trouble for many years seems to have culminated in the recent grievous accidents.

When a single electric company in this State does a business of over $10,000,000 a year, it is safe to say that an important new industry has grown up "in our midst."—*Boston Globe.*

If the *Globe* had the Thomson-Houston Electric Company in its "midst" we think it would give vent to a hearty ululation. The sentiment that the electrical industry is important is true and worthy of the *Globe*, midst or no midst.

The advantages of the electric railway for mail and express service are beginning to force themselves upon the officials of the express companies and the government. Already this service has been established in a western town, so far as the express is concerned, and the people of St. Louis want the electric roads to get the mail service. A bill has been passed by the Missouri State Legislature providing for an extension of the powers of street railway companies so that they may make contracts for carrying mail.

The German press is not allowed a special rate on its telegraphic correspondence, the government making no discrimination. In all other countries press despatches are transmitted at greatly reduced rates, but Dr. Stephen, director of the German telegraph, recently declared that he saw no reason whatever for favoring the newspapers thus. As a result of his illiberal policy the press messages of Germany constitute only one and a half per cent. of the total traffic and the German newspapers are among the dullest on earth.

The Brush Electric Light Company, of New York, desiring to be on the safe side and not wishing to come in contact with Mayor Grant and the Board of Electrical Control, the night of April 16 stripped from their poles on Whitehall street all the electric light wires, and, coiling them up, carted them away in wagons. Then with axes a gang of men cut the poles, throwing them into the street, thus effectually and completely shutting off that part of the city from the use of the electric light until the subways are properly established.

The electrical exhibition at Frankfort will be open from May 15 to October 15. It appears that the French electricians are not so effusively patriotic as their fellow countrymen who make pictures; the French government has issued a notice that firms or individuals wishing to exhibit can make arrangements through the Secretary of the Ministry of Commerce. We had always understood that art was international in the best sense of the word, but the French artists, by their refusal to exhibit at Berlin, showed that they think otherwise. French electricians, it seems, have no such mistaken ideas of patriotism, and when we consider how truly international and universal electricity is and what it has done to bring the nations of the earth nearer together, it is obvious that it would be the height of absurdity for them to follow the example set by the Parisian artists.

NEWS vs. HISTORY.

News has been defined as "the record of transactions." What more important transactions have recently occurred in the electrical field than the opening of the Paris-London telephone line and the annual meeting of the Thomson-Houston Electric Company? Both transactions were epoch-marking events in the electrical progress of the Old and New Worlds.

The ELECTRICAL REVIEW was the *only* electrical or scientific journal that printed the record of these transactions as *news.* We have thus compelled our esteemed contemporaries to deal with these matters as history.

The REVIEW's article on the Franco-British telephone line thoroughly covered the subject; in fact, a part of the story was sent by cable from London by a gentleman widely known as an authority on the telephone.

As a factor on the financial side of the electrical question of to-day, the splendid report made by the Thomson-Houston Electric Company at the end of its fiscal year was of great value and importance. It appeared in full in the REVIEW last week. This week our several esteemed but sadly belated contemporaries will probably publish it.

The public in general is respectfully reminded that the ELECTRICAL REVIEW not only completely represents the great science and industry of electricity but is at all times an *electrical newspaper.*

THE PATENT CENTENNIAL.

The celebration in honor of the centenary anniversary of the U. S. patent system, held at Washington, was a pleasant affair to all participants. A number of interesting papers were read. Several of these appeared in the REVIEW. It is to be regretted that the inventors of the country were so sparingly represented. An important feature of the occasion was the formation of an association of inventors. The valuable results in controlling hostile or lethargic patent legislation which may flow from such an organization have already been pointed out in the REVIEW. After much disagreement about no one knows what, the handful of inventors present effected an organization, with Dr. Gatling as president. This, at least, will start the ball rolling. Every inventor should take a hand in this matter. The immediate work to which the organization should address its energies should be, first, to cover with its membership every inventor of note in the country, and their concentrated effort should be directed upon Congress to relieve the present congestion in the Patent Office. The Interior Department and Land Office, which have pushed themselves into the building paid for out of the *patent fund for the use of the Patent Office,* should be ignominiously bounced and Congress should be made to provide them with quarters elsewhere.

While these squatters are grandly occupying the larger part of the building with one desk to two rooms, the Patent Office is literally killing its corps by filling each room with from six to ten clerks and the necessary office paraphernalia. A large amount of sickness and a number of deaths are directly attributable to this cause. All this is hard on the inventor. His cases lie in the examiners' rooms awaiting action. A reduced and insufficient complement of examiners prevents early examinations; danger is invited of rival applications being filed and of expensive interference contests arising.

The Association will find work to do in combating a growing opposition to patents among farmers; it is perfectly clear that those offering such opposition do not know on which side their bread is buttered. As was well said by several of the distinguished speakers at Washington last week, there is no other factor of our great national prosperity so large as the fruits of invention. An important object to be attained is the establishment of more liberal international patent laws. We are gradually drifting toward that, but this Association can expedite matters by showing the State Department what is needed and how to get it. The organization of an Inventors' and Manufacturers' Association was the most important incident of the Patent Centennial and it is hoped the inventors of this country will show a livelier interest in their welfare by aiding the organization than they did last week by their conspicuous absence from the Congress of Inventors.

CORRESPONDENCE.

OUR BOSTON LETTER.

Mr. Henry B. Cutter, prominently identified with several electrical enterprises in Philadelphia, was in this city on Friday.

Mr. Geo. D. Stonestreet, a member of the American Institute of Mining Engineers, is sojourning for a short time at the Quincy House, this city.

Mr. J. Edward Wallace has been appointed manager of the railway department of the Eastern Electrical Supply and Construction Company, this city.

Mr. Converse J. Smith, formerly treasurer of the Tripp Manufacturing Company, this city, is now a special agent United States Treasury Department.

Mr. Edward H. Kitfield, the well-known civil and electrical engineer, has removed his offices from No. 8 Oliver street to the State Street Exchange, this city.

Mr. R. W. Rollins, until recently district engineer of the New England department of the Westinghouse Electric Company, has accepted position as assistant superintendent of the Hartford Electric Light Company.

Messrs. J. A. Grant & Company, New England agents of the McIntosh & Seymour engines, report recent large sales aggregating nearly 2,000 horse-power. The firm has now in hand several very nice contracts.

Mr. Charles E. Bibber, formerly with the Holtzer-Cabot Electric Company and now manager of the Consolidated Electric Manufacturing Company, of this city, will start to-day on a business visit to Chicago and will return in about two weeks.

Mr. Henry C. Hawks, for a long time manager of the Boston branch office of the North Western Construction Company, has resigned that position and started in business for himself as electrical engineer and contractor, with offices at 620 Atlantic avenue, this city.

Russell Electric Company, of this city, has issued invitations to a large number of its customers and friends to visit the company's factory at Ballardvale, Mass., Monday, April 20, 1891, where an exhibition will be given of a complete circuit of Russell arc lamps.

Mr. C. F. Hutchinson, vice-president Eastern Electrical Supply and Construction Company, of this city, has severed his connection with that enterprising concern owing to pressing demands upon his time and attention by the New England Printing Telegraph Company, of which he is the general manager.

Successful Electric Railway Enterprise.—A Maine paper states that the Augusta and Gardiner, Me., Electric Railway has proven to be one of the best investments in Maine. The road has been operating but one season and the stock now cannot be bought at par. The original promoters of the enterprise are said to have made about $10,000 apiece.

Massachusetts Electrical Engineering Company, of this city, is enjoying an extensive trade with electrical supply houses, and has a rapidly increasing patronage from electric light and power companies owing to the reliability of its tested fuse wire. In filling an order this wire is first carefully tested, and then its actual fusing-point and advisable carrying capacity (under standard conditions) determined.

The Rhode Island Telephone and Electric Company, of Providence, R. I., has taken the sole agency of Burt & Tobey's electric wire coupling. This coupling is a useful device which recommends itself to the electrical trade by its simplicity, strength and cheapness as a wire joint. It is made in brass or copper; both straight and T shape in form, and may be quickly applied by the aid of a pair of ordinary plyers and a fluid lamp.

Messrs. J. E. Wilson & Company, representing the Rollins engine, have located in commodious offices at No. 8 Oliver street, this city. Mr. J. E. Wilson, the senior member of the firm, has for several years been identified with electrical enterprises in this city and is well known among the electrical people of New England. Mr. Wilson reports that his firm has received the contract to install at once at the power station of the Concord, N. H., Street Railway Company, a 250 horse-power "Rollins" engine. Mr. Wilson will personally superintend this installation.

Telephone Ball.—At Odd Fellows' Hall Wednesday evening, April 15, the employés of the New England Telephone and Telegraph Company gave their first grand ball. About 200 couples were in attendance, and a large number of invited guests were present, among whom were several well-known electricians. The following named officials of the company were present: President Thomas Sherwin, General Manager Jasper N. Keller, Assistant General Manager W. J. Denver, Treasurer W. R. Driver, Auditor S. W. Leedem, Traveling Auditor F. J. Boynton, Superintendents J. W. Duxbury, N. W. Lillie, James Menzies and Geo. E. Hanson, Attorney F. A. Houston, Cashier Charles D. Wells, electrician, I. H. Farnum.

The West End Street Railway Company experimented this week with a new motor car that has been designed by Mr. Pfingst, expert mechanic of that company. The new motor car is 15 feet long and contains a very large motor which has power to draw two or three heavily loaded cars in tow. The new car will be used in cases where large crowds are to be carried to any one part of the city. The operation of the new car is mechanically much the same as the ordinary car, only on a much larger scale. In the trial trip, from the Bartlett street station to the Tremont House, loaded cars were towed which made the total weight 70,000 pounds. The motor worked well, but the resistance coils were too easily heated. This latter can be remedied, so Electrician Pearson, of the company, thinks. The new motor car can attain a speed of from 15 to 20 miles an hour.

Boston, April 11. W. I. B.

OUR CHICAGO LETTER.

Mr. D. B. Dean, of the Electric Merchandise Company, has returned from a several weeks' trip in the South.

Mr. E. R. Gilman, of the Great Western Electric Supply Company, has just returned from an extended trip in the East.

Mr. G. E. Fisher, secretary and treasurer of the Commercial Electric Company, of Detroit, was a visitor in Chicago this week.

Foree Bain.—No electrician should be without one of Foree Bain's new catalogues. Mention the REVIEW and ask for one. You'll get it.

Readers of this journal should not forget that 435 Rookery is the lucky number of the REVIEW's new Western office. You are all welcome.

Mr. N. R. Baker, president of the National Car Heating Company, was a caller at the Western office of the ELECTRICAL REVIEW this week.

W. A. Sheldon, well known throughout the country as the genial special agent of the Schuyler Electric Company, was a recent caller at this office.

Professor Barrett has recovered from his recent severe attack of the grippe, and we shall, no doubt, see a noticeable boom in World's Fair electrical matters.

Mr. Geo. L. Korkham, is the genial manager of the North Western Electrical Specialty Company, manufacturers of electrical specialties, No. 1017 Chamber of Commerce Building.

The Demand for the new Gladiator dry battery manufactured by the North American Electric Company has reached such proportions that it is impossible to fill orders as promptly as desired.

Geo. Cutter has been appointed Western agent for Pettingell, Andrews & Company, manufacturers of the well known K. W. rosette cut-outs. Mr. Cutter is also pushing trade of the Schaefer lamps.

Mr. Fisher, of the Mosher Arc Lamp Company, reports numerous orders for these lamps. The orders being, in a great many cases, increases coming from those who have been testing the merits of this lamp.

One Company, after making an exhaustive test of the Sunbeam incandescent lamp, have decided to use this lamp entirely in their business. They are consumers of between 75,000 and 100,000 lamps per year.

Mr. W. D. Green, for some years superintendent of the Michigan Telephone Company, at Bay City, Mich., has just left for Kansas City to take charge of the branch house of the Central Electric Company.

Sixty Street Car Equipments for the Citizens Street Railway, of Memphis, Tenn., was the contract captured by the Edison General Electric Company this week. There are two motors to each car, or 120 motors in all.

Mr. Wm. Hood has secured the entire premises a portion of which he has occupied for some months. He now has two very attractive show windows in which are displayed the products of the Electro-Dynamic Company and the Accumulator Company.

The Board of Directors of the Pumpelly Storage Battery Company have decided to sell by auction, April 30, the entire patents bills, machinery and all rights, etc., of the company, to be sold to the highest cash bidder.

The Central Electric Company have been appointed Western agents for the Connecticut Motor Company, of Plainsville, Conn., and will carry a stock of these motors at their stores in St. Louis, Kansas City, Denver and Omaha.

The New Motor for turning bridges, which the Thomson-Houston Electric Company have been building, will be tested on the large Rush street bridge in a few days and if satisfactory, electricity will be used on all the bridges in this city.

Mr. Anton Klaus, sole owner and manager of the Jamestown, Dak., Electric Light Company, operating the Brush arc system and the Edison incandescent system, was a visitor in Chicago this week. Mr. Klaus is a firm believer in storage batteries for auxiliary work.

Over 50 letters were received in one day this week by the Great Western Electric Supply Company, some orders, some inquiries regarding their new Sun arc-lamp for incandescent currents. The demand for their G. W. incandescent lamp continues to increase.

Mr. J. A. Rohmberg, president of the Dubuque Electric Railway, favored us with a visit this week. The handsome accumulator cars built by the J. G. Brill Company recently purchased by Mr. Rohmberg have arrived and will be in running order very shortly.

The Walter Hay Manufacturing Company, manufacturers and dealers in electric specialties, will shortly have ready for distribution a handsome descriptive catalogue of the articles manufactured by them. They have at present over 1,000 orders for their new adjustable bell which is just about ready for the market.

The Belding Motor and Manufacturing Company are now in full working shape in their new factory. All departments are compelled to work overtime. Mr. Possons, the general superintendent, and Mr. Dexter, general manager, have been out of the city a few days overseeing the starting of an electric road of their system.

Mr. J. A. Rohmberg, president of the Dubuque Electric Street Railway, who is just returning from the East, spent a few hours in Chicago. Mr. Rohmberg is very enthusiastic over the working of his accumulator car, and while in the East purchased nine more of the beautiful cars, some of which have already been delivered, balance to follow shortly.

Mr. D. L. Patriarche is a late and desirable acquisition to the house force of the Central Electric Company. Mr. Patriarche has charge of the store sales department, and as such occupies one of the important positions of the company. He is a genial gentleman, and if courtesy in trade means anything, should merit a large share of it.

Mr. Milton Thomas, western manager of the New York Safety Steam Power Company, reports among recent sales the following: A 100 horse-power steam plant for Stevens' Point, Wis. A 60 horse-power steam plant for Carbondale, Ill. A 30 horse-power engine for H. M. Lemington, Chicago. A 30 horse-power engine for the Cereal Milling Company, Chicago.

The Central Electric Company, with their usual enterprise, have just secured the general western agency for the New York and Ohio Company's lamp, made at Warren, Ohio. This is the celebrated Packard lamp that is so favorably known among consumers, and is considered by practical men to be one of the very best incandescent lamps yet produced. The new American ammeter and voltmeter, lately described in these columns as one of the Central Electric Company's new specialties, are now ready for delivery. They are put up in a handsome box, with a handy carrying strap, and present an elegant appearance. The published price list shows the instrument to be so low that every one connected with an electric plant of any importance can have one.

Chicago Electric Club's Annual Election.—The annual election of officers of the Chicago Electric Club, which took place on Thursday evening, April 16, was an enthusiastic and hotly contested one. There were several tickets in the field and, therefore, considerable earnest lobbying was indulged in. The name of Mr. B. E. Sunny, who was elected president, appeared on every ticket, and his election was unanimous. The polls were open from about 5.15 until 7 P. M. A good sized vote was polled, but not as large as that of last year. Following is a list of the new officers for the ensuing year:

President, B. E. Sunny. Vice-presidents, first, F. B. Badt; second, Alex. Kempt; third, D. P. Perry; fourth, Geo. C. Bailey. Secretary, W. A. Kreidler. Treasurer, F. S. Terry, Board of Managers. F. E. Degenhardt, chairman; E. Baggot, J. P. Barrett, F. G. Beach, W. H. McKinlock, E. R. Gillman, M. A. Knapp, C. H. Wilmerding, F. W. Parker, W. B. Pearson. Membership Committee, Geo. Cutter, C. C. Haskins, G. A. E. Kohler.

For the past year the Electrical Supply Company's business has increased to such an extent that they have, from time to time, been obliged to secure additional space. First, storerooms, etc., were secured in adjacent buildings, then the local trade increased to such an extent that they were compelled to give up considerable of their office room on the first floors, securing the upper floors for their electric railway department, fixture department, etc., etc. At last they have decided to give up entirely the quarters at present occupied by them, and will, about July 1, remove to a new location. They have secured the large six story building on the northeast corner of Michigan avenue and Randolph street. The building has a frontage on three streets. It is 44 feet wide, 160 deep, and the actual floor space will amount to something over 35,000 square feet. For railway facilities it cannot be excelled, being located within almost speaking distance of three very prominent railroad depots. Mr. Terry is much elated at securing this very desirable location. L. W. C.

Chicago, April 18.

Mr. Henry J. Conant, of the Evans Friction Cone Company, Boston, was a New York visitor last week.

OUR ALBANY LETTER.

Mr. Coggeshall has introduced a bill in the Senate, authorizing the Railroad Commission to require railroad tunnels to be ventilated and lighted by electricity, or otherwise, to be done within 30 days under a fine of $500 per day.

A bill has been introduced in the Assembly by Mr. Drypolcher, providing that the New York board of electrical control shall, before January 1, 1892, cause to be built sufficient subways to enable the placing underground of all overhead electric light and power wires in New York city, which, in the opinion of the board, should be placed underground, and within 90 days of the completion of such subways, all overhead electric and power wires along the line thereof shall be placed in the said subways.

On Monday, April 6th, the Hudson River Telephone Company's exchange offices, in the big marble building, Nos. 468 and 470 Broadway, were burned out again, and the entire service of the city is again disabled. The company carries an insurance of $12,000. Manager Uline said: "I am in favor of closing up the exchange here. I am satisfied that the telephone company and the single trolley motor system cannot exist together in the same city. I have just received a telegram from President Davis, of the company, asking my opinion on the matter of continuing business under the present conditions. As I feel now I would advise closing up the exchange until the new building is erected. But we will always be in danger of fire coming in on us any minute." At the meeting of the common council, the next night after the fire, an ordinance was passed requiring the Watervliet Railway to place guard wires over its trolley wires; a like one concerning the Albany Railway trolleys will be introduced at the next meeting. L. M. W.

Albany, N. Y., April 11.

PERSONAL.

Mr. J. F. Morrison, of Baltimore, prominent in electric light circles since the industry was begun, was a New York visitor last week.

Mr. Benjamin Rhodes, manager of the Brush Electric Light Company, Niagara Falls, N. Y., was a caller at the REVIEW office last week.

Mr. D. I. Carson, general superintendent of the Southern Bell Telephone Company, is recovering from his recent illness and is expected at his office in New York in a few days.

Mr. O. S. Hussey, one of the many bright engineers connected with the Thomson-Houston Motor Company, came over from the Hub last week and paid the REVIEW office a pleasant visit.

Mr. Albert Lincoln Salt, of the Western Electric Company, and Miss Minnie Bergen were married in Brooklyn, April 15. Mr. Salt's business associates in the Western Electric Company presented him and his bride with a handsome silver service.

Mr. Louis Walsh, one of the most experienced battery men of the city, formerly with the Daft Electric Company and more recently with the Crosby Electric Company, has accepted a responsible position with Messrs. Alexander, Barney & Chapin, 20 Cortlandt street, New York. Mr. Walsh will be the manager of the battery department of this enterprising company, and no better man for the work could be found.

FINANCIAL.

Closing quotations of electric stocks, from F. Z. Maguire & Co., Electrical Securities, 18 Wall street, N. Y., Saturday, April 18, 1891. New York, Boston and Washington Stock Exchanges.

NEW YORK.	
Western Union Telegraph Co	81¼
American Telegraph & Cable	82
Central and South American	*145
Mexican	*210
Commercial Cable Co	105
Postal Telegraph Cable	39
Edison General Electric Co	96¾
" " " Deferred	
Consolidated Electric Light	
Edison Electric Illuminating Co	78
United States Electric Light	30
North American Phonograph	
BOSTON.	
Thomson-Houston Electric Co	47
" " " Preferred	93¾
" " " Series C	9
" " " Series D	7¼
" " International Co	
" Welding Co	
" European Welding Co	55
Ft. Wayne Electric Co	13½
Westinghouse Electric Mfg. Co	14
TELEPHONE:	
American Bell	205
Erie	48¼
New England	50½
Mexican	.85
Tropical American	.85
MISCELLANEOUS:	
Edison Phonograph Doll	.50
WASHINGTON.	
Pennsylvania Telephone	25
Chesapeake and Potomac	58
American Graphophone	5¼
United States Electric Light (Wash'ton)	174½
Eckington and Soldiers' Home Electric Railway	55
Georgetown and Tennallytown	62

*Ex. Dividend.

⁂ It costs eight shillings, or nearly $2, for a three minute talk over the London-Paris telephone line. The enterprise is proving a financial success.

⁂ C. F. Hoff has been granted the franchise to build a telephone line within the city limits of Tucson, Arizona. He will begin work within a short time.

⁂ The law of 1889 taxed telephone companies doing business in Indiana one per cent. of their gross receipts. The new law reduces this tax to one-fourth of one per cent.

⁂ The Hudson River Telephone Company, of New York, was fined $1,873.36 last week by Judge Andrews for failing to pay personal taxes. The Westchester Telephone Company was fined $431.

⁂ It is intended to build a telephone line between Zittau and Reichenberg. This will establish connection between Berlin and Vienna, as lines already exist between Berlin and Zittau, and between Vienna and Reichenberg, through Pesth.

⁂ A charter has been granted to the East Bluehill, Me., Telephone Company. The line will extend from Bluehill to Surry *via* East Bluehill. The line will be opened from Bluehill to East Bluehill as soon as the frost is out of the ground.

⁂ George M. Brown, for the past five years manager of the Southern New England Telephone, in Rockville, Conn., and local operator for the Postal Telegraph Company, has closed his engagement to accept a position in the central office at Hartford.

⁂ Mr. Charles A. Matcham, formerly manager of the Allentown Telephone Exchange, and lately of the Lancaster, Pa., Exchange, has tendered his resignation and will accept a position with the Bell Telephone Company, of Philadelphia.

⁂ The stockholders of the Erie Telephone Company, at their special meeting in New York, last week, voted unanimously —31,000 shares being represented—to ratify the action of the directors with reference to the sale of the company's southwestern division.

⁂ The stockholders of the Mexican Telephone Company met in New York last week and elected the following board of directors for the ensuing year: Robert Colgate and O. P. Dexter, of New York, and W. F. Smith, F. H. Harrington, J. D. Sargent, Robert Bacon and J. H. Dawes, of Boston.

⁂ When the new switchboard at the Boston office of the New England Telephone and Telegraph Company is in full operation, the force of operators will be materially increased. The new operating room is conveniently arranged, and is, altogether, one of the best in the country. The long distance portion of the board is already in use and giving very satisfactory results.

⁂ The Mexican Telephone Company has submitted plans to the city council of Mexico city for a reconstruction of its wire and pole service. It is proposed to substitute for the existing arrangements iron poles 30 feet long, carrying cables not more than 1½ inches in diameter in certain districts, requiring some five miles of cables. In other districts 30-foot wooden poles may be used to carry not more than 16 wires. The municipal tax payable by the company for 15 years is 50 cents per pole per month. In addition the company agrees to carry gratis for the municipality a system of electrical fire alarms. Not later than three months after the approval of the contract by the governor of the federal district the company must begin to erect cables, putting up at least 20 iron posts every three months. The new fixtures must all be in place within two years after the approval of the concession. The duration of the contract is to be 12 years from the time when the erection of the new fixtures is completed.

⁂ The Hudson River Telephone Company, at Albany, has had a hard time of it this Winter and suffered to a great extent from storms and other causes. The storms, recently, did about $15,000 damages to the wires and poles of the company. Just a little while previous to that an electric current that did not belong there got into the switchboard and did about $3,000 damages, and previous to that two severe storms of sleet and wind and snow did several thousand dollars' damage.

Telegraph and Telephone Interests in Pennsylvania.

The annual report of Secretary of Internal Affairs T. J. Stewart, on railroads, canals, telegraphs and telephone companies in the State of Pennsylvania, has been issued. The telegraph and telephone companies report a capital of $94,588,822, and a floating and funded debt of $15,902,424. The entire cost of the lines and equipment is placed at $4,346,836.

More About the Working of the London-Paris Telephone Line.

The telephone line between London and Paris was opened for public service on the first of the month. There are at present two offices in London, one in Threadneedle street, close by the Stock Exchange, which is expected to provide many customers for the service, and one at the general post office. Very shortly a third public pay station will be opened in the West End, near Charing Cross. This and the post office station will give permanent service, so that London and Paris can talk together at any time, day or night, Sunday or week day.

The charge for conversation is eight shillings ($2) for three minutes. Not more than two consecutive conversations will be allowed to any customer if other applicants are waiting at any of the offices to use the telephone. Those who desire to speak directly to Paris from their offices or residences in London will be provided by the post office with the necessary wires and apparatus at a certain fixed rental, varying with the length of line required to be built from the central office. These private wire renters will pay the same charge for conversations, and will take their turn in securing communication in the same manner as those who go direct to the pay stations.

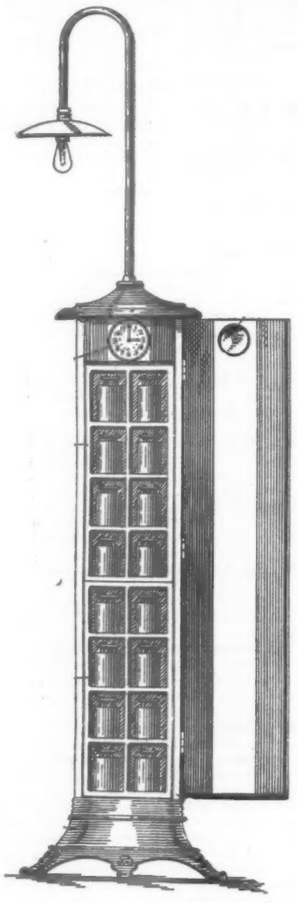
On the day before the opening of the line to the public, invitations were sent to various merchants and members of the Stock Exchange and heads of city houses to make a trial of the service free of charge. These invitations were accepted in great numbers, and all day long messages were passing to and fro between the two capitals. Considerable pains have been gone to in providing a sound proof cabinet for the users of the telephone to sit in when speaking. Numerous experiments were made and, finally, a booth was constructed with the sides lines with sheet lead and doe-hair. This lining effectually deadens all vibrations and not a sound can be heard outside. The speaker is hermetically sealed in the booth by a padded door edged with india-rubber. As soon as he takes his seat at the telephone an incandescent lamp is lighted, the connection being made by the seat. The only drawback to the comfort of this booth is that it is entirely unventilated, but this difficulty can, no doubt, easily be overcome. There is a pane of glass in the door of the booth so that the official in charge can see the customer at the telephone, though unable to hear him.

It is said that the sound of the voice is not heard so clearly at the Paris end as in London. A number of experiments were made on this feature, in which it was clearly evident that there was a notable difference in the volume of sound arriving at the Paris end to that observed in London. This is accounted for by the influence of the cable, which is about one-third of the total distance nearer to London than to Paris. Although this fact may partially account for the difference in reception at the two ends of the line, we incline more to the belief that the reduction in the volume of sound observed in Paris is principally due to the length of underground line in that city. This line, as stated in the article published in a recent issue of the REVIEW, is four miles and a half long, and unless the electrostatic capacity is very low, it would, undoubtedly, tend to deaden the transmission from London to Paris. It would be very interesting to know the exact electrical conditions of this portion of the line.

An interesting piece of testimony as to the excellent working of the new line is afforded by residents of Paris who have long been accustomed to use the line between Paris and Brussels. They state that the hearing by the London line is far superior to that by the Brussels one, which is 100 miles shorter and goes overhead the entire distance.

Portable Electric Lamp for Street or Lawn Uses.

We illustrate herewith a device designed by H. H. Carpenter, of Chicago, Ill., intended for street or lawn lighting at points where an electric lighting current is not accessible. The device comprises, as will be understood from an inspection of the engraving, a case or stand provided with shelves, upon which a series of secondary battery cells may be mounted, and carries a bracket, to which is secured an incandescent



lamp. The device is controlled by a time switch so that the circuit may be closed and the lamp lighted at any desired hour. The case is provided with a door in which is arranged a bull's-eye, through which the clock may be seen when the door is closed. The apparatus when completed weighs about 200 pounds, which gives it sufficient stability for the purposes for which it is designed.

Office Change.

The rapidly increasing business of the Chicago branch house of the B. F. Sturtevant Company, of Boston, has necessitated its removal to new and much larger quarters at 16 South Canal street, Chicago, where an entire new building furnishes ample accommodations for the large stock of blowers, exhausters, heating and ventilating apparatus, portable forges and steam engines.

This branch will remain under the energetic control of Foss & Noble and will form the headquarters for the trade of the Middle and Western States. The stock will be greatly increased in order to provide for immediate shipment in all cases, and a corps of experienced engineers will be maintained for estimating upon and installing plants for heating, drying, ventilating, etc.

The International Electrical Exhibition at Toulouse, France, will open May 15 and continue until September 15.

The Massachusetts House Committee on Manufactures reported separate bills to permit the towns of Wakefield and Hudson to install systems of municipal lighting.

The Introduction of Drugs into the Human Body by Electricity.

READ BEFORE THE PHILADELPHIA ELECTRO-THERAPEUTIC SOCIETY, THURSDAY EVENING, FEBRUARY 12, 1891, BY FREDERICK PETERSON, M.D., CHIEF OF CLINIC, NERVOUS DEPARTMENT, VANDERBILT CLINIC, COLLEGE OF PHYSICIANS AND SURGEONS, NEW YORK.

It is with some degree of diffidence that I have ventured to accept the kind invitation of the former president of your society to read a short paper upon the subject of Electric Cataphoresis, for the reason that I have already written about all that I know concerning it, and that I already find myself placed, with many of my good friends, among hobby riders. Just as some of them are designated, or at least in danger of being so-called, Apostoli cranks, bacillus cranks, hydrotherapeutic cranks, and the like, so I have begun to hear faint whisperings of a similar term applied to myself in connection with anodal diffusion. But I wish to shun the imputation at once, by stating that it is not a panacea for all human ills, that, indeed, it is useful in only a few conditions of the human system. Presuming, then, that its limitations as a therapeutic agent are many, it is in order to speak of it first historically and then practically.

While the diffusion of solutions through a membrane by the anode, and of the sarcous substance of the muscle from the anode to the cathode, had been known to electricians, the earliest investigation of its power to drive drugs through the human skin was made by Richardson in 1859 with morphine, aconite and chloroform. Nothing further was written until 1886, when Wagner, Adamkiewicz, Lumbroso, Matteini and others, re introduced the subject in connection with chloroform. Corning and Reynolds made some experiments later with cocaine solutions upon the anode.

My own trials have been conducted since 1888, and the results published from time to time since then. (Electric Cataphoresis as a Therapeutic Measure, *N. Y. Medical Journal*, April 27, 1889. Note on a New System of Exact Dosage in the Cataphoretic Use of Drugs, *N. Y. Medical Journal*, November 15, 1890. Farther Studies of the Therapeutics of Anodal Diffusion, *N. Y. Medical Record*, January 31, 1891.) The drugs made use of have been cocaine, chloroform, menthol, aconitia, onabain, strophanthin, carbolic acid, strychnine, succinimide of mercury, corrosive sublimate, iodol, iodide of potash, helleborin and the citrate, benzoate and chloride of lithium. Within a very short time experiments have been carried on by Cagney, of London, Gärtner, of Vienna, and Edison in this country, with the results of all of which you are doubtless familiar.

When my first paper was read before the section in theory and practice of the New York Academy of Medicine, the cataphoretic power of the galvanic current was still so little understood that considerable incredulity, if not positive disbelief in the existence of such a power, was manifested by some who participated in the discussion. But so much has been accomplished since then, that there is no longer any doubt as to the actual diffusion of drugs in solution through the skin and into the subcutaneous tissues by the galvanic anode, and it only remains to be established what actual therapeutic value over and above any other means of administration this particular method may possess, and to what disorders it may be especially applicable.

One of the reasonable criticisms has been that even if drugs were diffused as stated, exact dosage was impossible; but this is no longer a valid objection, since, very recently, it has become possible to make the doses accurate and certain.

A number of electrodes have been devised for cataphoretic purposes, some of them quite complicated, like those of Adamkiewicz, Munk and my own. But these are now no longer necessary. The cataphoretic electrode should be very simple—an ordinary metal one, either with or without a covering of cloth or sponge. Electrodes of tin are the cheapest, and the oxides may be easily scraped off when they collect. Gold or platinum would be better, but are very expensive, about equally so.

The ordinary sponge electrodes may be employed with solutions, such as those of lithium, iodide of potash, iodine and the like, where precision in dosage is not required; the plain metal ones, however, for the more careful administration of medicaments like cocaine, aconitia, strychnine and helleborin. A narrow rim of rubber around the metal serface is needed to prevent evaporation. A disk of cotton cloth, or tissue or blotting paper, may be cut to fit the metallic surface, and upon this is dropped any desirable quantity of the drug in solution. The wet disk of paper is next the skin and prevents burning.

It is sometimes useful to prepare the skin a little before treatment, by rubbing with ether, to dissolve out the oil globules. The anode being applied with the drug, the cathode may be placed anywhere upon the surface of the body and a current of any endurable strength turned on. The stronger the current the speedier the effect.

Besides the use of these simple electrodes, it is often desirable to make more extensive applications over wider areas. If, for instance, it were wished to diffuse a solution of lithium about a large joint like the knee, a sufficiently large strip of zinc is covered with sponge or cloth, saturated with the solution, tied around the extremity, to be then connected with the anodal rheophore. For diffusion through the whole body a bath-tub is used, one either constructed for the purpose or any ordinary bath-tub. The common bath-tub of our houses is readily converted into an anode by placing a large sheet of zinc on the bottom and connecting it with an insulated copper wire. The sheet of zinc is then covered over with a board to prevent its contact with the body. When the patient is immersed in the bath, he merely keeps one arm out to grasp the cathode and the circuit is made.

These are in brief the means by which drugs are introduced into the body, and it is clear that any soluble agent may be employed in some one of the ways described. The poisonous medicaments, which are to be administered in accurate doses, are kept either in solution (cocaine 10 to 20 per cent., helleborin one per cent.), or disks of filtering paper impregnated with solutions and dried, and containing a known quantity of the remedy, are kept on hand for the purpose. Such cataphoretic disks may be made by any pharmacist. (Otto Boeddiker, pharmacist, 564 Sixth avenue, New York, makes them for my use).

As regards now the therapeutical advantages of anodal diffusion, it would seem as though it had its widest applicability in maladies of the skin and mucous membranes, or of immediately subjacent tissues; but, of course, it may be given a much greater scope in conjunction with mineral, antiseptic and alterative baths, which is a problem for the investigations of others in the future.

Dermatologists have already evinced considerable interest in the subject, but I have no doubt that the rhinologist, laryngologist and gynecologist, who have so much dealing with mucous membranes, will, in the course of time, avail themselves profitably of a power which promises so largely.

Surgeons have employed it frequently and successfully for local anæsthesia in minor surgical operations.

The physician cannot fail to take up the particular line pointed out by Edison, and make use of local applications by means of sponges, or generally by means of baths, for the purpose of influencing local and systemic affections, like gout and rheumatism.

I was led myself into making a study of electric cataphoresis by my own work in a neurological line, and my first experiments were conducted with a view to relieving pain. I received the suggestion after vainly endeavoring to combat severe supraorbital neuralgias in several patients. All known appliances and agents of the healing art had been ineffectual, blistering, electricity, aconitia and the progressive series of narcotics and anodynes, which generally terminate with the morphine habit. One of the patients had suffered from morphine inebriety for a year, but had recovered from that with her supraorbital anguish unassuaged. I found that 10 to 20 per cent. solutions of cocaine on the anode gave absolute relief in these cases for from 4 to 10 or 11 hours, and without constitutional effects of any kind. A deep analgesia was produced in the area covered by the anode. No doubt constitutional effects would ultimately result by indefinite continuance of the application.

Since that time I have made it a point always to use the cocaine solution in any sort of superficial pain in which I think the anode to be of advantage. The method does not mitigate neuralgic pains which owe their origin to lesions far back of the point to which the electrode is applied, as in disease of the Gasserian ganglion, or the idiopathic neuralgias of central origin; and it is here that cocaine cataphoresis has an actual diagnostic significance. If the pain is relieved by the treatment, the lesion is in the immediate neighborhood or peripheral to the anæsthetized area, and this would furthermore suggest the possibility of permanent cure by neurectomy. This idea of the diagnostic value of cocaine cataphoresis is Dr. Starr's, and it has some sort of corroboration in a case of intense supraorbital neuralgia which I lately saw with him. A 20 per cent. solution of cocaine, used with a strong current for a considerable period of time, did not diminish the paroxysms of pain in the least. A few days afterward neurectomy was performed, and this also had no effect upon the neuralgia.

Cocaine employed in this way does not *cure* neuralgias of peripheral origin. All that is claimed for it is that it gives relief without producing constitutional effects, and is, therefore, superior to any narcotic given internally, and to any other local application.

Other local anæsthetics are chloroform, aconitia, onabain, strophanthin (Arnaud's), helleborin, menthol and carbolic acid.

Chloroform causes a dermatitis, and should be used only when counter-irritation is desired in conjunction with a transitory anæsthesia. I have employed chloroform cataphoresis in one case of cervical neuralgia with good effect. Helleborin and aconitia I have also used successfully, but the latter, while it gives rise to a deep analgesia, also causes painful smarting and burning, unless combined with a cocaine solution.

While my experience with the method has been chiefly in neuralgias of superficial nerves, I have not failed to give it a trial in other conditions where it seemed to be expedient. I have been using cocaine and helleborin with the anode in two cases of tic convulsif of late, placing the electrode over the trunk of the facial or one of its branches. Whatever may be the explanation of its effect, these cases certainly show very great improvement and a remarkable diminution of the spasm after each application, such as was not obtained from the employment of the electric current alone. In case of blepharospasm, cocaine cataphoresis practiced near the outer angle of the eye produced a very marked change in the extent and frequency of the movement. I have no doubt, however, that the results would be better still if we had some drug to use with the anode which would act upon motor nerves in the same way as the local anæsthetics act upon sensory nerves; if, in other words, we had some trustworthy local paralytic. Atropia and curarin do not seem to answer the purpose.

There can be no doubt that the effects of the galvanic current upon nutrition are in part due to the cataphoretic transfer of molecules of protoplasm and liquid from one cell to another, or from a cell to a capillary vessel in the path of the anodal stream, and since the diffusion takes place more readily and more quickly in direct proportion to the current strength, it behooves us to employ as many milliamperes as feasible in our galvanization of the atrophied and paralyzed extremities of poliomyelitis, chronic neuritis and peripheral nerve trauma. Moreover, there would seem to be a possible advantage in the use of nutritive emollients in conjunction with the labile application of the anode to the atrophied member, just as they have been combined from time immemorial in the exercise of the aliptic art (massage). ("The Aliptic Art," by Frederick Peterson, M. D., Philadelphia *Medical News*, August 11, 1883.)

As a last word, let me say that while the constant current has proved so useful to the medical profession for diagnosis, for stimulating nerve and muscle, for electrical endoscopy, for cauterization, we must not neglect its cataphoretic property, by which remedial agents are diffused through the tissues and fluids of the body to improve nutrition, to produce anæsthesia, to relieve pain, to destroy germs, to modify morbid processes, and to make soluble chemical combinations with deleterious substances which frequently collect in the organism.

.... The damage to the Western Union Telegraph lines in Massachusetts by the last storm was something unprecedented. In certain sections in the western part of the State there are miles of poles still lying flat on the ground and the wires are in an almost inextricable snarl. The work of repairs is being pushed as rapidly as possible, but it will take weeks of time and thousands of dollars to put the wires back into the same condition as before the storm.

New Electric Cigar Lighter.

The illustration presented herewith shows a new type of electric cigar lighter manufactured by the Barr Electric Manufacturing Company, 17 and 19 Broadway, N.Y. The device is simple in construction and not high in price. The body of the lighter is a bichromate cell, the zinc being plunged into the solution by pressing down on the knob,

ELECTRIC LIGHTER.

as shown in the cut. A platinum wire is heated to incandescence by the passage of the current and is protected from injury by the little shield shown in front. The lighters are soaked with alcohol and are ignited by being brought in contact with the platinum wire.

Metal Covered Tubes of the Interior Conduit and Insulation Company.

We illustrate on this page a new form of the well-known interior conduit made by the Interior Conduit and Insulation Company, of this city. The company has been frequently called upon to furnish a metal covered tube for decorative purposes, extra protection against mechanical injury, absolute fireproofing and protection against the deleterious elements of cement. Fig. 1 illustrates the metal covered tube. The interior tube is drawn through a die and an outer covering of either brass, steel or iron drawn upon it, fastened and securely sealed by an ingenious lapping of the seam. The tubes are joined together by screw couplings. In order to guard against any liability of moisture or condensation providing a leak to the outer covering of the tube, a pliable washer is inserted between the two abutting ends of the tube as shown in illustration. Fig. 2 illustrates two separate tubes covered with one piece of metal drawn on as the one above described. This double tube will be made in sizes one-quarter and five-sixteenths inch inside diameter, and will be found useful as a substitute for moulding, and for exposed work.

FIG. 1.—METAL COVERED TUBE FOR ELECTRIC WIRES.

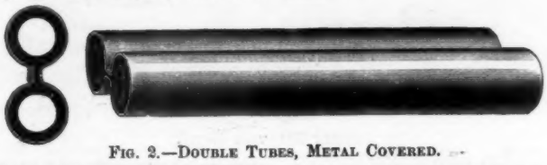


FIG. 2.—DOUBLE TUBES, METAL COVERED.

The Position of Copper.

"The deliveries of copper in England and France during March," says the *Pall Mall Gazette*, "although 1,500 tons less than in the same month of 1890, exceeded the total supplies, the former being 9,962 tons and the latter 9,284. The stocks are now reduced to 58,353 tons, as compared with 91,938 tons a year ago. We have reached about the normal level, the present amount being slightly under that of three years ago. America has been shipping copper to Europe lately, but if the large home demand for the metal which was experienced last year is renewed this Spring, as is quite expected, these shipments will cease. The consumption for electrical purposes in this country is also sure to be large, but it remains to be seen how far that may be set off by the decreased requirements for other industries, notably ship building, which is not nearly so active as it was a year ago. The present price of copper at £53 per ton compares with £48 15s. a year ago and £39 15s. two years ago."

TELEGRAPHIC

.... Cable rates to Australia will be reduced 50 per cent. May 1.

.... The Northern Pacific Railroad Company operates about 1,800 miles of telegraph lines.

.... The semi-annual dividend of the Commercial Union Telegraph Company has been reduced from five to three per cent.

.... The Pacific Postal Telegraph Company will this week move into its new and handsome building on Market street, San Francisco.

.... The Michigan Postal Telegraph Company is reported to have sold its lines in Michigan to the Postal Telegraph Cable Company for $60,000.

.... The Postal Telegraph Company's three wires have been stretched along the new road to Sumas, Wash., and the Canadian Pacific road is building a line to meet it there.

.... The Commercial Union Telegraph Company have opened new offices in Thomaston, Damariscotta, New Castle, Warren, Woolwich, Waldoboro and Rockland, and expect to extend their lines to Belfast, Me.

.... The annual election of the Atlantic Postal Telegraph Cable Company was held in New York April 14, and resulted in the election of A. B. Chandler, president; W. H. Baker, vice-president; E. E. Platt, treasurer; J. O. Stevens, secretary. These four officers and T. L. Cuyler constitute the board of directors.

.... At a meeting of the Asiatic Society of Bengal, at Calcutta, a piece of cable was exhibited showing that the India rubber covering had been pierced by a blade of grass. The piercing was so complete and the contact with the copper core so perfect that "dead earth" was produced and the efficiency of the cable destroyed. The species of the grass, owing to its dried up condition, could not be determined.

.... The Postal Telegraph Cable Company wants to build a line on the road-bed of the Norfolk and Western Railroad Company, in Prince George County, Va. A commission appointed by Judge Rives, of Petersburg, decided April 16 that the telegraph company might run its line on the north side of the railroad track and pay $200 damages. Exceptions have been taken by counsel for the railroad company, and the case may get into the United States Supreme Court.

Electrocution News.

Justice Calvin E. Pratt of the Supreme Court on April 16, denied the motion for a stay of the execution of Nicola Trezza, pending an appeal from the decision of Judge Moore of the Court of Sessions, Brooklyn, refusing to grant a new trial to the Italian criminal. His counsel, ex-Judge Abram H. Dailey, says he has discovered new evidence that Trezza shot Alexander Salvano in self-defense.

Justice Pratt in his opinion says that the court before which the case was tried was the proper tribunal to pass upon the question of any new evidence that might have been discovered.

Mr. Dailey will move in some other court for a stay, and if he does not succeed in securing delay, he proposes to make an appeal to Governor Hill for a reprieve for his client.

Warden Brush, of Sing Sing Prison, was served with papers last week staying the execution of Charles McElvaine, the murderer. The stay was issued by Judge Lacombe of the United States Circuit Court. The papers in the case are returnable April 20.

Warden Brush said that everything was in readiness for the execution of Trezza this week, and that if he received no notice of a stay in Trezza's case by Saturday, he would send out the required notices to those who are to witness the execution.

* * Up to March 1, 1891, there had been built in the United States 2,852 miles of electric railway.

* * The first open car trip on the Jamaica, L. I., Electric Railway was made April 13, the car being No. 20, a handsome new one.

* * First Steps in Electricity" is the title of a recent book. Stepping on a live wire is one of the "last steps," isn't it?—*Boston Post.*

* * A company with a capital of $35,000 has been organized to build an electric street railroad to connect the villages of Waverly, Sayre and Athens, N. Y.

* * A telegram from Mansfield, Ohio, says that the electric street railway of that city has changed hands, the bondholders of New York selling out to a local company.

* * Transactions of the American Institute of Electrical Engineers, for April, 1891," contains Mr. J. J. Carty's paper on "Inductive Disturbances in Telephone Circuits."

* * Mr. Frank B. Tracy, son of the Secretary of the Navy, has charge of the New York department of the Thomson Electric Welding Company. He is a thorough business man.

* * California cities cannot grant franchises to electric railroads, and the legislature is unwilling to change the law unless the companies desiring franchises will agree to use the storage battery system.

* * The West Side Power Company, of Minneapolis, Minn., will construct a large addition to the big plant at the foot of Third avenue north. The addition will be of brick and stone, 95x48 feet, and two stories in height. It will cost $10,000.

* * The Winnipeg, Man., council last week accepted the proposals of the Street Railway Company to establish an electric system 12 miles long to be completed in 18 months, the company being given extension of the franchise for 25 years.

* * Deputy Sheriff Finn, of New York, has received another attachment against the United Electric Traction Company, of No. 115 Broadway, for $60,125, granted by Judge Patterson, of the Supreme Court, in favor of Elizabeth S. Maitland on 21 promissory notes made between July 31 and November 17, 1890.

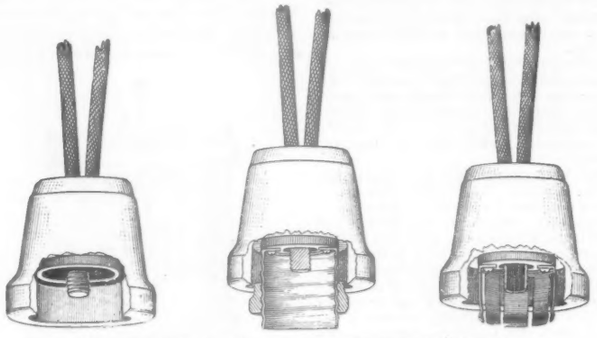
* * The street railways of St. Louis, Mo., carried 17,546,415 passengers during the three months ending March 31, 1891, and the cars made 1,106,048 trips. This is an increase of 3,680,074 passengers and 107,439 trips over the same period in 1890. The estimated cash receipts for the first three months of 1891 at five cents per trip, were $877, 270.75, an increase of $184,003.70 over the same quarter of 1890.

* * Mr. Robert Grimshaw, general editor of the trades department of Funk & Wagnalls' Standard Dictionary, being desirous of making as complete as possible his list of mechanical and industrial terms, requests manufacturers of machinery and tools having important parts not found on those of other makers, or the names of which are not yet in general use, to send the name, definition and use of each such part to him at 115 Bible House, New York city.

* * At Jersey City, N. J., the Sub-Surface Electric Company, to operate in Jersey City, Hoboken and New York, with a capital of $2,000,000, to acquire and dispose of letters patent relating to machinery, apparatus and devices for use in or connection with the operation of railway cars by electric power, or in lighting, heating, driving fans or the propulsion of lifts or elevators. The incorporators are William McMahon, Rahway; Herbert Knight, Brooklyn, and Bernard Lande, New York.

Cartwright Electrical Specialties.

We illustrate on this page several specialties invented by D. J. Cartwright and manufactured by J. S. Potter, 9 Quincy Row, Boston. A new waterproof socket made for Edison, Thomson-Houston and Westinghouse lamp bases, is shown in Figs. 1, 2 and 3. This socket is claimed to be absolutely waterproof, durable and cheap. Fig. 4 shows a three wire porcelain cleat. The cleats for a circuit are all put up and then the wire is run through. All these devices have been patented by Mr. Cartwright and are made of the best vitrified porcelain.



FIGS. 1, 2 AND 3.—CARTWRIGHT WATERPROOF SOCKETS.

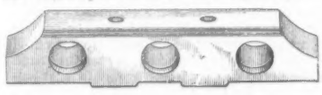


FIG. 4.—CARTWRIGHT THREE WIRE PORCELAIN CLEAT.

Making the Wires Safe.

An officer of engineers of the Prussian Army has discovered a simple device by which all danger from falling electric wires can be avoided. It consists of a spiral spring attached to the top of the pole or other support for the wire. When the wire breaks, the recoil of the spring shuts off the current, and the wire falls dead to the ground, bereft of its dangerous fluid. Germans have always been famous for their management of fluids of all kinds. In this case, however, it seems doubtful whether the spring would recoil quickly enough to shut off the current before it has time to do any damage. When it comes to a go-as-you-please race between a spiral spring and an electric current, most people would prefer to bet their money on the electricity. Still, the German's idea is a good one and well worth trying.—*Boston Globe.*

In Hungary the principal railway company is conducting experiments in train lighting by electricity. Eight cars have been fitted up, accumulators of the Tudor type being employed to furnish current. If the experiments are successful the system will be applied to all trains. This is a branch of electric lighting that has not made great progress in this country, but we hope yet to see the day when none other but electric light shall be used on all our railroad cars.

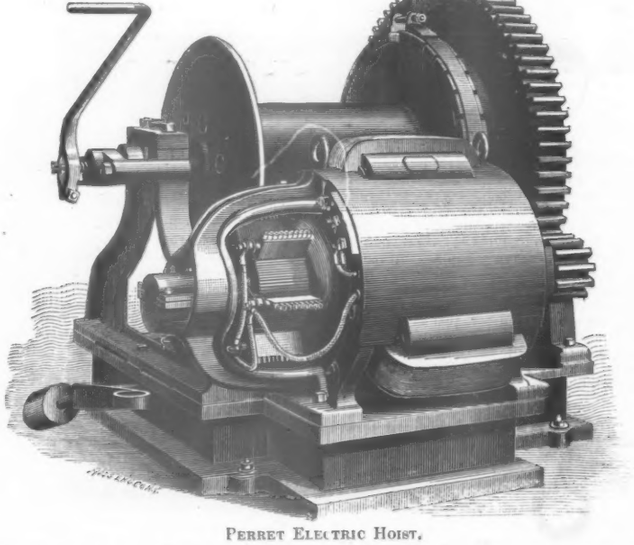
"Shocks and Sparks."

[From the Albany *Journal.*]

The ELECTRICAL REVIEW calls Kate Field's *Washington* "one of our brightest contemporaries" and its editor "one of the most brilliant of women." No one doubts that; but the query is: How do Kate Field and *Washington* come under the province of electrical review? Is one shocking and does the other give out sparks?

Perret Single Reduction Electric Hoist.

The introduction of the Perret slow-speed multipolar motor a year or so ago marked a progressive event in the history of electric power, and the remarkable success attained by this motor has resulted in overthrowing the general opinion which at that time prevailed, that slow-speed multipolar motors were impracticable. These motors have since been applied to almost every conceivable kind of work requiring single reduction or direct gearing, and have proved a decided success in every instance. We illustrate above an electric dock hoist brought out several months since by the Elektron Manufacturing Company. This is a piece of machinery where single reduction is particularly desirable on account of the saving in space, noise, friction and consumption of current. The motor is a 15 horse power Perret multipolar, making 450 revolutions per minute, geared by a gun metal pinion to a 38 inch gear on the drum shaft of hoist. The drum is one foot in diameter, giving a speed on hoisting rope of a little over 200 feet per minute.



PERRET ELECTRIC HOIST.

The motor is shunt wound and drives the gear wheel at a constant speed, which may be increased if desired by the introduction of resistance in the field circuit. By depressing the hand lever the hoisting drum is forced against a friction device revolving with the gear wheel and lifts the load, its speed varying with the pressure on the lever. To lower the load the foot lever is depressed and the hand lever raised. The whole machine is very compact and simple and is built to stand rough dock usage. The motor is waterproof and has all the latest improvements

A Speechless Phonograph.

There is a certain class of people which is always ready to decry the merit of a great discovery or invention because some imaginative mind had, at a prior time, conceived the result possible and prophesied its ultimate accomplishment. For example, Bell's invention of the telephone to this class appears fully anticipated in the experiment of Philip Reis or in a description of a similar arrangement to that employed by Reis which was published, long prior to Reis' experiments, in an obscure German newspaper. So there is now going the rounds of the scientific press the following detraction from the honors fully due Edison for the phonograph:

When the phonograph was invented by Mr. Edison, we fancied, says the St. Louis *Republic*, that we had at last discovered something new under the sun. "Surely," we said, "the phonograph at least is new." We imagined that nothing like it had ever been dreamed of before. But there is where we were wrong again. Something almost exactly like it was invented when Edison was barely out of his cradle, and more or less dim premonitions of the modern marvel haunted the minds of men centuries ago. In the year 1859, the famous Abbé Migne read a paper before the British Association, describing an instrument called a phonautograph, which had but a short time before been invented by a young Frenchman, M. E. L. Scott.

The following is a quotation from the Abbé's paper, and may be found in the transactions of the British Association for the year mentioned above: "The phonautograph consists of a tube enlarged at one end in the same manner as a trumpet, in order to concentrate the sounds which are conveyed through it to a thin membrane tightly strained over the other end of the instrument. This membrane carries affixed to it an excessively light stylus or pencil, which is put in motion by every vibration produced by the action of the voice upon the membrane. Behind this stylus is a band of paper covered with lampblack, which is unrolled by clockwork, and as this band passes along the point of the stylus, traces are left in the lampblack of all the curvilinear and rectilinear movements originating in the vibrations of the membrane, thus producing in its own peculiar characters a faithful reproduction of the sounds."

This quill-driver of a wild Western newspaper is gifted with double vision—or more exactly speaking—mental astigmatism. The Abbe's work was very clever so far as it went; he showed a high order of ingenuity in recording the sound waves, but it did not occur to him that the record might be employed to *reproduce* the sounds themselves. That leap of the imagination which bore the divine imprint of genius was made by Thos. A. Edison—one flash of thought and it was done. If we are not mistaken, in the Smithsonian Institution, at Washington, there is an instrument which is a practical embodiment of the Abbe's ideas and which was there long before the phonograph was born. But all the heavy scientific minds which pondered over it—and some minds which, like that of Joseph Henry, were accompanied by equally heavy intellects—never thought that *if the crank were only turned backward* speech might be reproduced.

It has been pertinently remarked that a century of Reis could not produce the speaking telephone; it is equally true that a century of the Abbe could not make the phonograph talk. All honor to the man who does something practically useful. Purely scientific work is highly useful; it clears away the underbrush and enables principles to be more clearly understood; it removes the cobwebs which cloud the mind of a pioneer investigator and allows the light of truth to dawn upon him. The scientist wrests her most hidden secrets from dame Nature, and is, in a high sense, a benefactor of the human race; but the inventor who applies the abstract knowledge thus obtained to promote our creature comforts is equally worthy of our gratitude.

A story of unusual power and strange plot begins in the May *Cosmopolitan*, and will run through three numbers. Two other pieces of fiction will attract attention, two real war stories, by men who have been in the thick of the fight. One is by Archibald Forbes, the famous war correspondent, and the other by Albion W. Tourgee, author of "The Fool's Errand."

OUR ST. LOUIS LETTER.

A Representative of the Great Western Electric Supply Company was in the city recently, looking around for a good location for the branch they intend to establish here.

The Emerson Electric Company are taxing their capacity to the utmost, trying to fill orders. They have brought out some new specialties this week which they are placing on the market.

The Columbia Incandescent Lamp Company are getting out their new street railway lamp. They have already placed it on several of the St. Louis lines and have two representatives introducing it in the West and South.

The Bell Telephone Building is now completed and the general offices have already been moved in, though Mr. Durant, general manager, thinks it will be some time before the whole system will have been transferred.

About a Week ago the Chouteau avenue branch of the Lindell railway completed its line to Forest Park. On one of the cars of this line has been placed an air brake for experimental purposes. Used in connection with it is a whistle, which takes the place of a gong. Both air brake and whistle are working very satisfactorily.

The Mayor vetoed the bill allowing the Southern Railway (electric) to extend its line along Broadway to Washington street, his objection being that the overhead wires would interfere with the street traffic which is already hindered by the Broadway (cable) line. In view of the fact that there is at present on part of the proposed extension an overhead wire, which is used by the Union Depot Railway, his reasoning is hardly consistent.

The Southern Electrical Supply Company have received two large orders for wire from Texas and Iowa. They have recently issued a catalogue which is one of the most complete for electrical supplies out. Mr. McKinlock leaves this week to join his brother in Chicago and together they intend to make the circuit of the recent consolidation into the Central Electrical Supply Company. They are thinking of establishing a branch at Lincoln, Neb.

The St. Louis Electrical Supply Company reports a very brisk business. They are just preparing to place a new alternating current dynamo on the market. They intend to manufacture it here in St. Louis. They have secured the construction work on the new Chemical Bank Building, and have just filled their order for the Waco, Tex., electric railway, furnishing all the supplies and wire. They are also handling the goods of the Emerson Electric Company and report a brisk demand.

The Western Union Telegraph Company are rapidly moving into their new quarters on Pine street, between Fourth and Fifth streets. The work of transferring their wires has been a very tedious one and has taken over two weeks. The building will be fitted up with a most complete plant necessary for the carrying on of their business and will consist of 19 generators, of which two are of five volts, two of 30 volts and 15 of 70 volts power. These generators will take the place of the present battery system, which has proved too cumbersome for the present large service. The generators will be driven by two 15 horse-power engines, while a 30 horse-power engine will be used for the dynamo, which supplies the 450 incandescent light circuit. Their pneumatic tube service to the Merchants' Exchange has already been laid. With it messages can be sent from the Exchange to the telegraph office in five seconds. To operate the tubes two small engines have been installed in the basement. The ground floor is given over to the general offices, as is also the second floor. The Western Associated Press will occupy the third floor, while the operating rooms will completely take up the fourth floor. The building used is not a new one, being formerly known as the Lucas Building, but it has undergone such changes and improvements as to present a very good appearance. W. H. B.

St. Louis, April 9.

OUR CINCINNATI LETTER.

The Card Electric Motor Company have a well equipped shop for the manufacture of their motors and dynamos and are making a strong bid for business.

The Walton Architectural Iron Works manufacture a skeleton iron street railway pole which is strong and light in appearance. A large number are in use here.

A Thief with rather unusual proclivities broke into the office of a lumber yard in the western part of the city, the other night, and stole the telephone. Nothing else was touched.

The Central Thomson-Houston Company are now located in a handsome building at 264 West Fourth street. Mr. Stewart, the president, reports a brisk business for his company.

The Triumph Compound Engine Company, 213 to 217 West Second street, are building up a large business for their handsome and serviceable engine. It is valveless and noiseless, both desiderata.

Electric Railroads are now recognized by real estate syndicates as being one of the most valuable means of developing new suburbs. Several sub divisions near the city are reached by electric roads and a number of others are being built.

In the City Elections on April 6, Mr. Horstman, the Republican candidate for city solicitor, was elected by a majority of over 10,000. This is interesting because Horstman had incurred the enmity of the Cincinnati Gas Company, which vigorously opposed him; yet, in spite of the most powerful corporation in the city, he was elected by the handsome majority named. The gas company ought now to have a pretty fair idea of the estimation in which it is held by the citizens of Cincinnati.

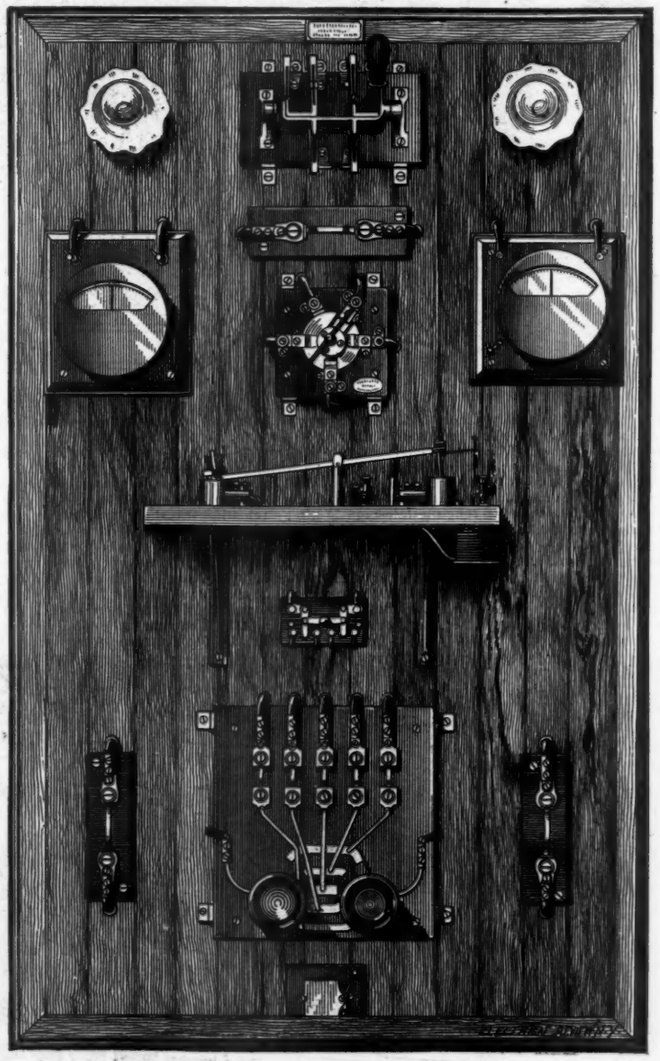
Traveling.—Dr. Chauncey M. Depew lectured before the New York Press Club not long ago on "Contrasts." If I remember rightly, Dr. Depew did not contrast the modern methods of travel with those of, say, ten years ago. It may be that the doctor felt a little delicacy about "talking shop" out of business hours. As I whirled along in the New York and Chicago Limited over the smooth track of the Pennsylvania Railroad, I could not help remembering the time when the two nights and two days between New York and Chicago or Cincinnati were so much dreaded. Inconveniences are unpleasant reminiscences. How different now! electric lights, a system of electric call bells, any number of servants ready to send telegrams and a stenographer to take down your correspondence, telegraphic or otherwise. All these and the many other conveniences are well known to traveling people; nd we are all more or less migratory, if only in the Summer time.

Cincinnati, April 9. S. L. C.

—— San Diego is short of funds and will have no street lights from now until the end of the fiscal year. The consequence has been an influx of tramps and thieves, and this again has resulted in a declaration by the citizens that the first man found committing an overt act of violence will be lynched.—*Oakland, Cal., Tribune.*

A Storage Battery Switchboard.

The accompanying illustration is an excellent representation of the switchboard in the office of Mr. Wm. Hood, 239 La Salle street, Chicago, Western representative of the Accumulator Company, of New York, and the Electro Dynamic Company, of Philadelphia. The board is not a large one, being only 3x5 feet, but it is complete in every particular. It was fitted up by Mr. W. F. Matteson, electrician for Mr. Hood. This switchboard controls an accumulator plant of 27 regular cells and five C. E. M. F. cells which are charged from a high tension arc circuit. The upper center switch represents a consumers' switch for throwing the arc current on and off. The ammeter on the left is controlled by the multiple ammeter switch between the two. This switch shows whether the plant is working at a gain or loss. The voltmeter on the right is controlled by the small two-way switch just under the large automatic center piece, and shows the voltage of the charging and lamp circuits. The large center piece represents an automatic switch commonly used for series wound machines. It is automatic both ways, cutting in the battery when the arc circuit is on and closing the arc circuit should a break occur, thus avoiding the opening of the arc circuit in case of accident. The large switch at the bottom is a compound cell regulating switch and throws in and out the C. E. M. F. cells, thus raising and lowering the voltage on the lamps. This is shown on the voltmeter above. The small appliance at the base of the board is a lightning arrester. All the appliances used on the board were made by the Electro Dynamic Company, of Philadelphia. This plant is capable of running 40 sixteen candle-power 50 volt lamps for 10 hours without recharging, and furnishes all the light required in Mr. Hood's offices.



IMPROVED STORAGE BATTERY SWITCHBOARD.—CHICAGO.

ELECTRIC LIGHT NEWS

—— The city council of Chehalis, Wash., has decided to build and operate its own electric light plant.

—— C. A. Vaniman, of Illinois, and F. M. Welch may organize a $20,000 stock company to erect an electric light plant at Alexandria, La.

—— As a result of a war between rival electric light companies at Waco, Tex., one of the companies has agreed to furnish the city with 50 arc lights at the rate of 90 cents per month each.

—— The Biddeford and Saco, Me., gas and electric light companies have been bought out and will hereafter be run under one management.

—— The long contested case of the Denver Club against the Consolidated Electric Light Company, of Denver, has been formally settled and dismissed.

—— The capital stock of the Bay City, Mich., Electric Company, which recently consolidated with the Home Electric Company, has been increased to $125,000.

—— The tall electric light towers at Sacramento Cal., are being removed from the streets, and in there place the intersection plan of electric lights in a line along the middle of the street is being substituted.

—— An order has been granted by Justice Lewis authorizing John J. Cassin, receiver of the Troy, N. Y., Electric Light Company, to sell the company's property at auction, after giving the notice required by law.

—— The war between the Consumers' and the Louisiana Electric Light Companies, of New Orleans, culminated April 16 in an application by James A. Renshaw to the civil district court for an injunction restraining the city from paying the Louisiana Company's bill of $11,637.73 for lighting the city for the month of March, and for the annulment of the contract for lighting between the city and the Louisiana Company, on the ground that there was no competition for the award, the Southwestern Brush Company, then the Louisiana's only competitor, having entered into a combine with its rival.

—— The directors of the gas company at Cincinnati, O., have taken preliminary action looking to an increase in capital by $500,000, making it $7,000,000. That means an addition of 5,000 of par value, $100 each. After this move shall have been consumated it will probably be in order to add 5,000 shares of par value, $5 each, to the capital stock of the Cincinnati Electric Light Company, making it amount to $350,000. It has heretofore been argued upon holders of gas company stock that they should provide themselves with an equal number of shares of electric stock, so to carry out this policy the stock of the latter must be increased with that of the former.

Electric Light on the Suez Canal.

Thanks to the electric light, the average time of transit through the Suez Canal goes on diminishing steadily from year to year. Last year it was 24 hours 6 minutes, whereas in 1889 it was 25 hours 50 minutes; in 1888, 31 hours 15 minutes; in 1887, 33 hours 58 minutes; and in 1886 not less than 36 hours. In the preceding year the average time for the transit of vessels traveling at night with electric light was 35 hours 30 minutes, or four more than the mean time in 1888, and in 1891 it has reached the short and quick passage of 22 hours 9 minutes. The shortest passage through the Canal by a steamer using electric light was made last year. The time was as much as 30 minutes faster than the fastest in 1889.

The Builders of the Steam Engine, the Founders of Modern Industries and Nations.

ABSTRACT OF ADDRESS BY ROBERT H. THURSTON, DIRECTOR OF SIBLEY COLLEGE, CORNELL UNIVERSITY, BEFORE THE INVENTORS' CONGRESS.

"There can be no more interesting and fruitful subject of investigation and study than that which notes the influence of the earlier and the later methods of philosophy upon the material progress of the world." The address deals with the growth of the steam engine from the first crude notion of Hero and his contemporaries, with their whirling eolipile, to the latest and most perfect of the modern refinements of the machine introduced by Watt in the last century. The work of science in producing the material civilization upon which all modern life, intellectual and moral, as well as physical, rests, is traced from the earliest to the latest times, and is shown to be that which has brought about the marvels of modern life. Its spirit is truth loving, it is absolute, exact and logical, and finds satisfaction only in seeking and identifying truth and in making real progress. As Macaulay has said: "It has lengthened life; it has mitigated pain; has extinguished diseases; increased the fertility of the soil; given new security to the mariner; furnished new arms to the warrior; and spanned great rivers and estuaries with bridges of form unknown to our fathers; it has guided the thunderbolt innocuously from heaven to earth; it has lighted up the night with splendor of the day. * * * Its law is progress."

A new invention is simply the materialization of a new idea of scientific character and useful purpose, an idea capable of supplying mankind with new comforts, new conveniences, new safeguards against want, pain, disease and death. Every new advance, in pure science, even, is sure to ultimately find use in the advancement of the race. There have been three great periods into which the history of mankind may be divided; that which gave rise to the older and speculative philosophies; that of the dark ages; that of modern renaissance in the arts and sciences. The steam engine was the germ of an invention in the first, lay dormant and useless throughout the intervening millenium, and came forward to do the work of the world in this, the latest age, that of invention, of scientific discovery, and of applications of science to the promotion of the welfare of the race. Speculative philosophy has given place to real science; and its first fruits, those of a single century, are more wonderful and productive than the outcome of the older spirit in the thousands of earlier years.

The speaker, in writing his "History of the Growth of the Steam Engine," some years ago, divided its period of development into three parts; that of speculative thought and suggestion; that of actual invention and application; that of refinement or perfection. The first comprised the times antecedent to Watt; the second, that of Watt and his contemporaries and immediate successors, up to the middle of the present century; the third is that of the present time, including the most recent and minute improvements and latest applications of science in the production of the modern engine and its use at sea and on the land, and to the impulsion of electrical machinery.

Papin, Worcester and Savery were the later successors of the ancient philospher, Hero, in the speculative stage, representing the inception of the intermediate stage of progress; but Newcomen, even more than Watt, is the inventor of the modern engine. He it was who gave it its modern form as a chain of mechanism, converting the old steam fountains of his predecessors into a real engine, in which engine, pump and working beam are distinguishable; each performing its appropriate office. James Watt, a hundred years ago, improved upon Newcomen's steam engine by introducing, after a scientific investigation of its defects, new devices, such as his separate condenser and his steam jacket, precisely adapted to his purpose of reducing the enormous wastes which he found to exist in the older machine. Watt gave us the familiar features of the modern engine, apart from its grander details, as supplied by Newcomen; the condenser, the governor, the double-acting type, the crank and fly wheel—ascribed to Wasborough—and the various special forms for special purposes.

But the help of the capitalist, always essential to success in whatever direction improvement is sought, was required, and this element of advance was supplied by Boulton, who became Watt's partner. Then the inventor and the man of business, working hand in hand, brought into use the fruits of the brain labors of the inventor of whom the poet sings:

> A creature he called to wait on his will,
> Half iron, half vapour—a dread to behold;
> Which evermore panted and evermore rolled,
> And uttered his words a million-fold.

Such was the outcome of this modern "trust"—a combination of the wisest legislation, the most brilliant invention and the most wisely applied capital, of patent law, brain labor and accumulated energy.

Since Watt, the work of improvement of the steam engine and its introduction has been largely done by American inventors, under the protection of the patent laws of the United States; and the country has reaped a magnificent harvest, as a result of this discreet sowing of seed in earlier days. Corliss made the modern steam engine, availing himself of a principle given the world by Frederick Sickels, and Fulton gave us steam navigation; the Stevenses carried into effect the ideas of Fitch, and a dozen inventors and constructors made successful the plans of the Stephensons in the building of the railways. And so, to-day, a ton of engine does the work of ten of the time of Watt; a pound of fuel gives ten times the power obtained from it in his day; a steamer now crosses the Atlantic in one-eighth the time demanded at the beginning of the century; avoidable wastes in the engine have been reduced from 80 per cent. to eight; a half ounce of fuel will transport a ton of cargo over a mile of ocean. Every wreath of steam rising to the heavens is a reminder of Hero, of Alexandria; while the hum of spindles is the song "In Memoriam" of Sickels and of Corliss, and every race and every nation is daily thus reminded of James Watt, who is now, through all these later builders of the steam engine, doing the work of the world.

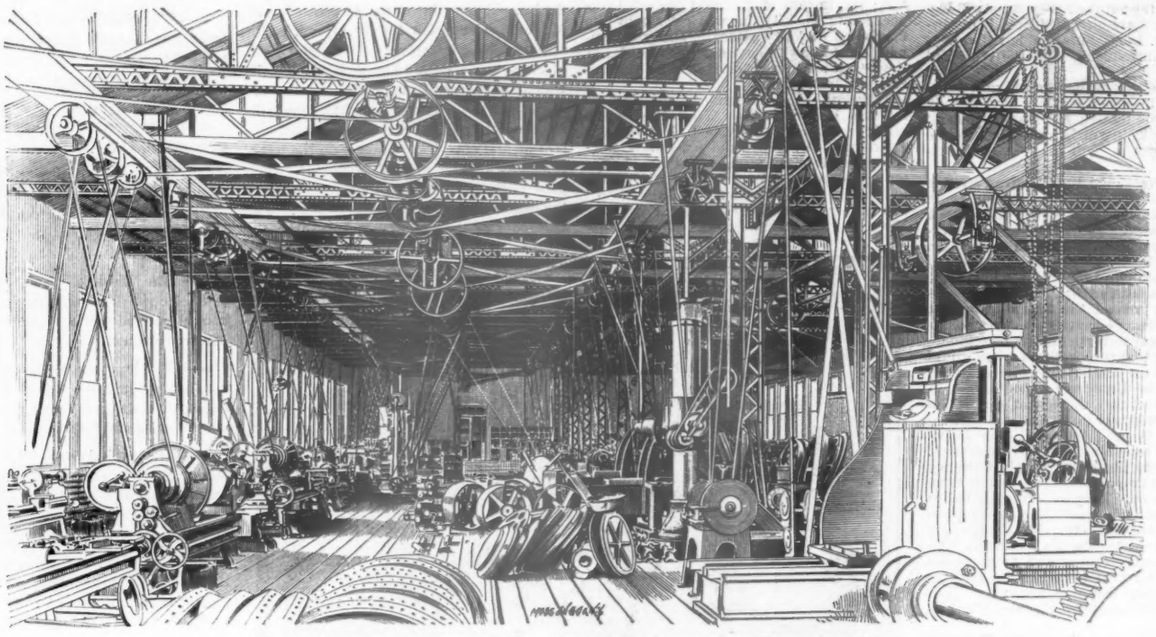


FIG. 1.—MACHINE SHOP OF THE TITUSVILLE IRON COMPANY, AT TITUSVILLE, PENN.

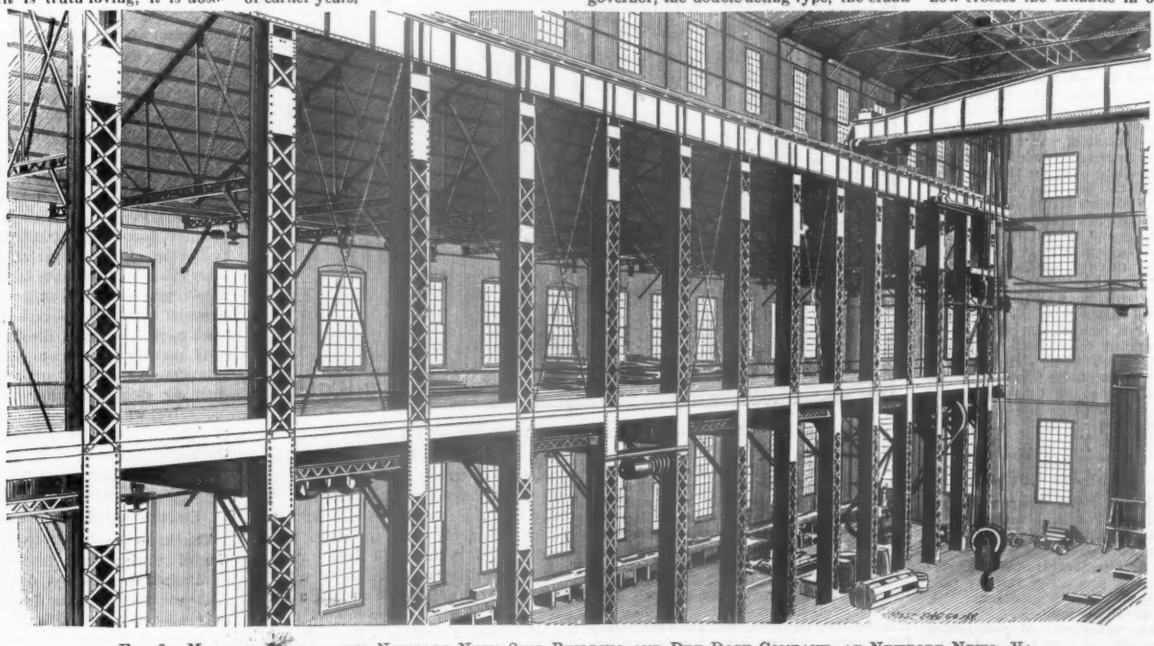


FIG. 2.—MACHINE SHOP OF THE NEWPORT NEWS SHIP BUILDING AND DRY DOCK COMPANY, AT NEWPORT NEWS, VA.

New Work of the Berlin Iron Bridge Company.

The above company, located at East Berlin, Conn., have recently finished the splendidly constructed iron buildings shown in the accompanying illustrations. In many respects the construction methods used in these examples are similar to those used in building electric light and power stations.

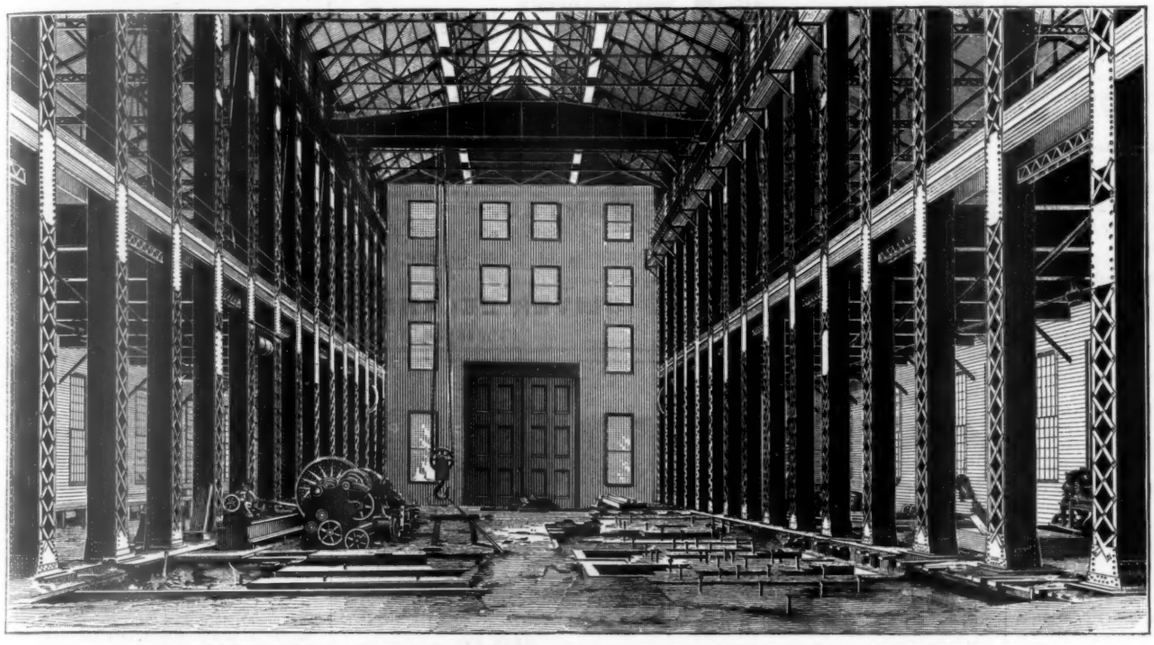


FIG. 3.—MACHINE SHOP OF THE NEWPORT NEWS SHIP BUILDING AND DRY DOCK COMPANY, AT NEWPORT NEWS, VA.

A machine shop built for the Titusville Iron Company, Titusville, Pa., is shown in Fig. 1. The building is 70 feet in width by 205 feet in length inside of walls. The roof trusses are made of iron, and so arranged as to carry shafting. Along the central portion of the building is a row of iron columns. The trusses are placed 10 feet apart. Where large amounts of shafting are to be carried from the roof, iron trusses are better adapted for the work than wood, as they are stronger and stiffer, and there is no danger of their shrinking and swelling from the action of the weather. An iron truss when placed in position will stand firmly and carry its load without vibration or deflection.

In Figs. 2 and 3 is shown the machine shop of the Newport News Ship Building and Dry Dock Company at Newport News, Va. This shop is 100 feet wide by 300 feet long, being divided crossways into a central portion 50 feet from center to center of columns, with each wing 25 feet 6½ inches in width. The central portion is controlled by a hydraulic traveling crane of 45 tons capacity. The rails of this traveling crane are placed 48 feet 5 inches from the top of the floor, so that large machinery can be moved over other large machinery standing on the floor. The wing portion of the building is two stories high, the lower story being 18 feet 1 inch in height, and the other floors 14 feet in height. The interior of the building is lighted with large windows in the outside walls of both galleries and in the end walls as well. Also on the sides of the central portion above the wing trusses there are large windows which admit light into the interior of the central portion of the building. Extending the whole length of the building is a ventilator with shutters on each side, opening and closing by cords from the floor. The interior of the building is also controlled by hydraulic jib cranes of five tons capacity, arranged to work in connection with the hydraulic traveling crane. All the framework of the building is made of iron, but the outside walls are of brick placed between iron posts and secured by iron braces connected with the posts. The roof is made entirely of iron, that is, iron trusses with iron purlins and corrugated iron covering.

A larger building is that illustrated in Fig. 4, the machine shop of the Link Belt Machinery Company, at Chicago, Ill. The building is 407 feet long by 124 feet wide, the width being divided into a central portion 41 feet 8 inches center to center of columns, and a wing on each side 40 feet from the center of columns to the outside of walls. The upper floor of the gallery in the wing portion of the building is supported by a column, which column is placed 19 feet 8 inches from the inside face of the wall, or 20 feet 4 inches from the center of the crane girder column. The roofs are made flat and covered with tar and gravel. The central portion of the building is served by a 25 ton hydraulic traveling crane which moves back and forth the whole length of the building, and the wings are served by jib cranes placed as may be required to serve different machinery. The height from the floor to the underside of the floor in the wing portion of the building is 15 feet 3½ inches, and the actual height of the upper floor is 11 feet 6¼ inches. The central portion of the building is 35 feet 5¾ inches from the floor to the top of the rails which carry the traveling crane. The interior is lighted by side windows in the outside walls, and the central portion of the building by windows in the sides of the lantern trustees. Lengthways the crane girders are supported on columns 36 feet apart, and the columns which support the gallery floors are placed 24 feet apart.

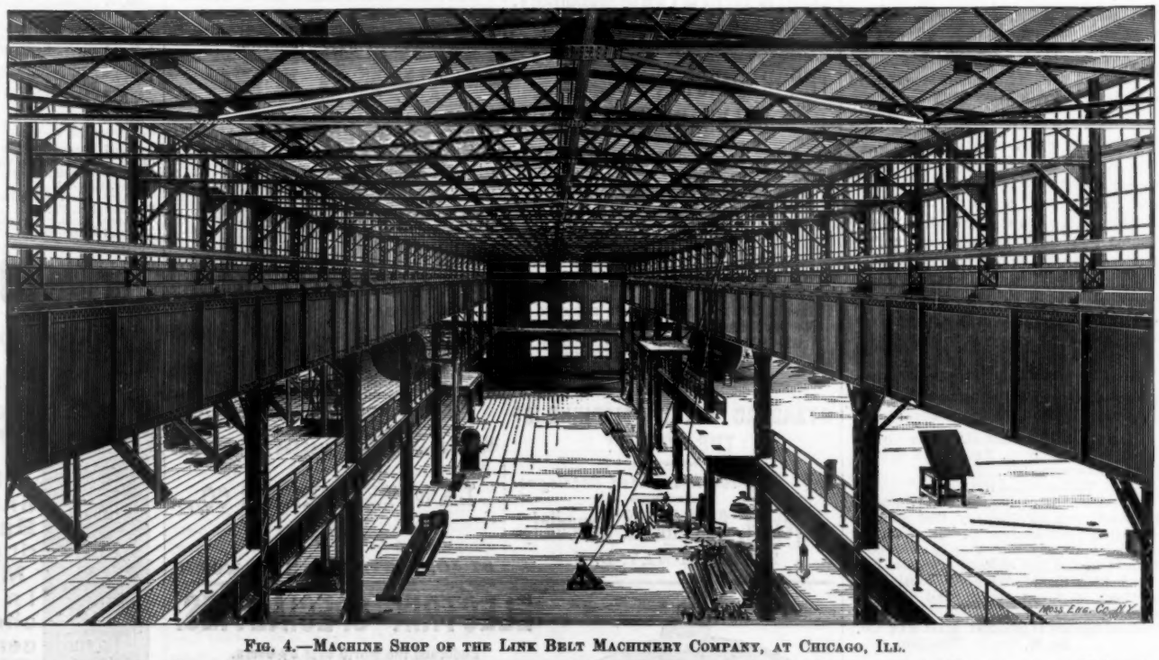


FIG. 4.—MACHINE SHOP OF THE LINK BELT MACHINERY COMPANY, AT CHICAGO, ILL.

The Norwalk and South Norwalk, Conn., Electric Light Company's plant was burned the evening of April 12. It is thought the fire was of incendiary origin.

Brewer people are now looking forward with much interest to the day when the electric cars will begin to run across the Penobscot from Bangor. The railroad company are going to build an annex on the toll bridge on which to lay their track. It is expected that they will have this completed by August and the Brewer people anticipate a little boom from it. They even think, some of them, that Bangor people may go over there to trade. That is not improbable. In Lewiston and Auburn, the currents of the shoppers set both ways, and it is so in other towns similarly located.—*Lewiston, Me., Journal.*

VIEWS, NEWS AND INTERVIEWS.

The Detroit Electrical Works has made application to list its stock on the Boston Stock Exchange. The capital of this company has lately been increased from $500,000 to $2,000,000. James McMillan is president, William A. Jackson, vice president and United States Senator Hugh McMillan is a director.

Dr. A. F. Mason, general manager of the Simplex Electric Company, of Boston, has gone on a trip to Jamaica and will be away several weeks. The Simplex Company claims that the sun never sets on the Simplex wire. Probably Dr. Mason has gone to strengthen a link in the chain of Simplex wire which encircles the earth.

At the Electric Club's annual election, last week, one member approached another and said: "Have you voted yet?"

"No. What's the use? There's only one ticket in the field."

"Guess not; there's three tickets."

"What are they?"

"Member's ticket, restaurant ticket and bar ticket."

The Postal Telegraph Company has in the employ of their Brooklyn office a messenger of the name of Joe Friend. Joe is a character. Although very young he has traveled over the greater part of the United States. He resigned his previous engagement as mascot to the Francis Wilson Opera Company to accept that of embryo Mercury.

Dr. R. F. Gatling, the inventor of the death-dealing gun which bears his name, believes that "if some one could invent a powerful electrical machine that would kill whole armies by the mere turning of a switch, there would not be a monarch in the world who would go to war."

Two boys of Newburyport, Mass., applied to the city authorities some time ago for a telegraph line of their own, and with an alderman's aid the desired permission was granted. They believe in encouraging the young in Massachusetts.

KINDRED INTERESTS

The business of the Shipman Engine Company, Boston, is widely extended and greatly varied in its character. Their engines are so convenient in build and so easily run as to be a welcome addition to many small establishments.

The Armington & Sims Engine Company, Providence, R. I., are sending out a steel engraved folder, in which they announce that since their reduced price list was issued a year ago they have made a still further reduction in prices.

The Ansonia Brass and Copper Company, 19 and 21 Cliff street, New York, are sending out a little pamphlet setting forth the merits of and giving much valuable information about Tobin bronze, of which they are the sole manufacturers.

The Stanley Electric Manufacturing Company, Pittsfield, Mass., have issued a truly tasteful and artistic catalogue fully describing the Stanley transformer recently illustrated in the REVIEW. The catalogue is the work of Bartlett & Company, of this city, and is on a par with their usual standard of excellence.

The Central Electric Company, Chicago, are making a special drive on hard rubber goods, offering the celebrated products of the Butler Hard Rubber Company, New York, at prices lower than ever, and making prompt shipments, which is telling with the trade and consumers. They are introducing a compound that takes a good finish and is specially recommended for its insulating qualities.

The Eureka Tempered Copper Company, North East, Pa., have received the following:

SOUTH TREDEGAR IRON COMPANY,
Chattanooga, Tenn., Nov. 25, 1890.
EUREKA TEMPERED COPPER COMPANY.

Gentlemen: We have tried your bearings on our nine inch rod mill and find they are standing up to their work all right so far and we think will do all you said they would. It connection will say this mill is very hard on bearings. Yours, very truly,

J. M. DUNCAN, Mgr.

Taylor & Son, 39 Dey street, New York City, manufactures of Taylor's Primary Batteries, report as follows: "We have just tested a Lugo motor for the Third Lighthouse Department. It is intended to revolve the lights on the light ships by a reliable motor and experiments are being made to select the best. With one charge of our depolarizing solution in nine cells we ran a Lugo motor 76 hours at a cost for solution of only 12 cents."

The Burton Electric Company, Richmond, Va., have received the following endorsement of their electric heaters:

HANNIBAL ELECTRIC RAILWAY CO.
HANNIBAL, MO., March 5, 1891.
BURTON ELECTRIC CO.,
Richmond, Virginia.

Gentlemen:—Replying to your favor of the 2d instant, beg leave to say, that we have been using your heaters all winter on our cars, and must say that they give us good satisfaction, and our citizens are more than pleased with them. We shall continue to use them, and can recommend them to others.

Yours,
(*Signed*) HANNIBAL RAILWAY CO.,
By M. Doyle, President.

The Crocker-Wheeler Electric Motor Company is about making extensive alterations in its general offices and works, which occupy the second floor of the large brick building bounded by West Fourteenth, West Thirteenth and Washington streets. The lively call for its perfected motors has made greater facilities for their manufacture a necessary, and to that end the company will soon double its room, taking an additional loft. Changes contemplated are a large show room for exhibiting all sizes of Crocker Wheeler motors, with their various applications, in operation, and a dust-proof department for the storage of finished motors and motor frames ready for being wound. The company find it necessary to carry a large number of motors unwound for filling special orders. Business is very good with this firm.

PAISTE CHINA SWITCHES.

5 and 10 Ampere Capacity.

FOR FINE RESIDENCE INSTALLATIONS.

IVORY TINTED, TERRA-COTTA TINTED,
BLUE TINTED, GREY TINTED,
YELLOW TINTED, PINK TINTED.
BRIGHT GOLD FINISHED,
DULL GOLD FINISHED,
JET BLACK FINISHED.

Cheap, Handsome, Durable. 5,000 in stock.

ASK YOUR SUPPLY MAN FOR THEM.

H. T. PAISTE,

1201 MARKET STREET, PHILADELPHIA, PA.

WANTED.—Price Lists of Dynamos and other electric apparatus, in order to procure an agency.

OLIVER ZELAND,
STOCKHOLM, SWEDEN.

"A BIG HIT!"

AN ADJUSTABLE HAMMER.

WE CLAIM this is the Best, Cheapest, Loudest Ringing and Handsomest Electric Bell in the United States.

WRITE FOR PRICES.

(Patent Applied For)

WALTER HAY MFG. CO.,

NEW CATALOGUE READY. CHICAGO.

MADE BY

Chas. A. Schieren & Co.,

New York, Chicago, Boston, Philadelphia.

IF YOU have anything pertaining to electric machinery you want to sell, send us the description.

IF YOU want anything pertaining to electric machinery, send us your inquiries.

FRANK RIDLON & CO.,
Dealers in New and Second-Hand
Electric Light & Power Machinery,
196 SUMMER STREET, BOSTON.

72-Inch Double Belt (Second Order) for LOUISIANA ELECTRIC LIGHT CO., NEW ORLEANS, LA.
Two 48-Inch Double Belts for LOUISIANA ELECTRIC LIGHT CO., NEW ORLEANS, LA.
One 54-Inch Three-Ply Perforated Electric Belt for TACOMA RAILWAY & MOTOR CO., TACOMA, WASH.
One 41-Inch Three-Ply Electric Belt for CITIZENS' ELECTRIC ILLUMINATING CO., BROOKLYN, N. Y.
Two 30-Inch Three-Ply Perforated Electric Belts for GAUTIER STEEL DEPT., JOHNSTOWN, PA.

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Double Cylinder Battery.

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1320 Wallace St., Philadelphia, Pa.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON APRIL 14, 1891.

450,131 Machine for covering cables; James D. Bishop, New York, N. Y.
450,153 Trolley for electric railways; Arthur S. Hick'ey, Richmond.
450,164 Electric railway wire support; Charles A. Lieb, New York, N. Y.
450,173 Electric switch for electric railways; Frank Mansfield, New York, N. Y.
450,175 Cable covering press; Charles H. Matchett, Brooklyn, N. Y.
450,182 Light signal system; Bernice J. Noyes, Boston, Mass.
450,189 Electric motor car; Francis A. Pocock, Scranton, Pa.
450,219 Dynamo-electric machine; William F. Collins, New York, N. Y.
450,221 Instrument for measuring electric currents; Henry H. Cunynghame, Frederick L. Rawson and Otway E. Woodhouse, London, England.
450,228 Printing telegraph; Pliny H. Fisk, New Richland, Minn.
450,245 450,466 Fire alarm and telephone system; Samuel W. Ludlow, Madisonville, O.
450,260 Thermostat; Wm. F. Singer, Carthage.
450,272 Telegraph relay; Robert O. Wickes, Troy, N. Y.
450,285 Galvanic battery; Walter A. Crowdus, Memphis, Tenn.
450,292 Circuit closer; William C. Johnston, Jr., Lynn, Mass.
450,294 Insulator. 450,587 Electric wire supporter; Charles A. Lieb, New York, and Edwin Lavens, Brooklyn, N. Y.
450,304 Art of making filaments for electric lighting; Silvanus F. Van Choate, Boston, Mass.
450,319 Rheotome; George E. Pragnel, Brooklyn, N. Y.
450,354 Porous cell for galvanic batteries; William Burnley, North East, Pa.
450,358 Auxiliary mouth-piece for telephones. 450,359 Receiving telephone support; William N. Marcus, Philadelphia, Pa.
450,367 Insulation of armatures for dynamo-electric machines; Rudolph Eickemeyer, Yonkers, N. Y.
450,384 Electric wire insulator; Daniel A. Bertolette, Norristown, Pa.
450,390 Electric time call; Richard Varley, Jr., Englewood, N. J.
450,426 Electrical apparatus for reproducing sounds; Jules E. Roulez, Paris, France.
450,441 Automatic switch for electric motors; Fenner E. Whipple, Philadelphia, Pa.
450,458 Electric signal; Robert H. Gruchou, Chicago, Ill.
450,460 Fender or safety attachment for electric or other cars; David Hines, Cambridge.
450,541 System of electrical distribution. 450,542 Reciprocating electric railway motor system. 450,543 Electro-magnetic reciprocating engine. 450,544 Pulsating current electric motor; Charles J. Van Depoele, Lynn, Mass.
450,551 Electric switch; Frederick Adam and John Knapik, St. Louis, Mo.
450,552 Armature; La Motte C. Atwood, St. Louis, Mo.
450,558 Electric call bell and indicator; William Cox, Toronto, Canada.
450,577 Regulator for electro-therapeutic apparatus; John H. Davis, Findlay, O.
450,581 Electric wire connections; Edward J. Gatley, Rome, N. Y.
450,586 Electric railway; Rudolph M. Hunter, Philadelphia, Pa.
450,589 Holder for electric cables; Joseph W. Marsh, Pittsburgh Pa.

Burnley Dry Battery

PATENTED JAN., 1890.

STRONGER than any Open Circuit Battery on the Market.

BETTER than any other Dry Battery yet produced.

Most compact in size and cheapest. 90 cents per cell. Discount to the Trade and in quantities.

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